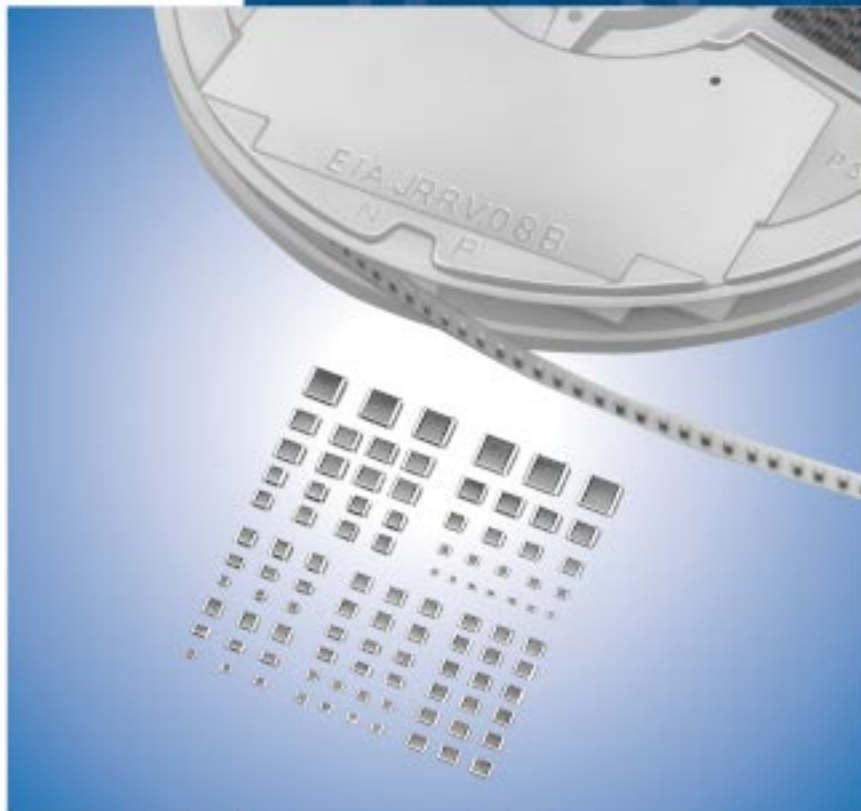


# Chip Monolithic Ceramic Capacitors



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- Please refer to "Specifications and Test Methods" at the end of each chapter of **9** – **14** .

#### for EU RoHS Compliant

- All the products in this catalog comply with EU RoHS.
- EU RoHS is "the European Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment".
- For more details, please refer to our website 'Murata's Approach for EU RoHS' (<http://www.murata.com/info/rohs.html>).

Please check MURATA home page (<http://www.murata.com/index.html>) in case you can not find the part number on the catalog.

## ● Part Numbering

### Chip Monolithic Ceramic Capacitors

(Part Number) 

|    |   |    |   |    |    |     |   |     |   |
|----|---|----|---|----|----|-----|---|-----|---|
| GR | M | 18 | 8 | B1 | 1H | 102 | K | A01 | D |
| ①  | ② | ③  | ④ | ⑤  | ⑥  | ⑦   | ⑧ | ⑨   | ⑩ |

#### ① Product ID

#### ② Series

| Product ID | Code | Series                                    |
|------------|------|-------------------------------------------|
| GR         | M    | Tin Plated Layer                          |
|            | 4    | Only for Information Devices / Tip & Ring |
|            | 7    | Only for Camera Flash Circuit             |
| ER         | B    | High Frequency Type                       |
| GQ         | M    | High Frequency for Flow/Reflow Soldering  |
| GM         | A    | Monolithic Microchip                      |
|            | D    | for Bonding                               |
| GN         | M    | Capacitor Array                           |
| LL         | L    | Low ESL Wide Width Type                   |
|            | A    | Eight-termination Low ESL Type            |
|            | M    | Ten-termination Low ESL Type              |
| GJ         | M    | High Frequency Low Loss Type              |
| GA         | 2    | for AC250V (r.m.s.)                       |
|            | 3    | Safety Standard Certified Type            |

#### ③ Dimension (L×W)

| Code | Dimension (L×W) | EIA    |
|------|-----------------|--------|
| 02   | 0.4×0.2mm       | 01005  |
| 03   | 0.6×0.3mm       | 0201   |
| 05   | 0.5×0.5mm       | 0202   |
| 08   | 0.8×0.8mm       | 0303   |
| 0D   | 0.38×0.38mm     | 015015 |
| 0M   | 0.9×0.6mm       | 0302   |
| 11   | 1.25×1.0mm      | 0504   |
| 15   | 1.0×0.5mm       | 0402   |
| 18   | 1.6×0.8mm       | 0603   |
| 1M   | 1.37×1.0mm      | 0504   |
| 21   | 2.0×1.25mm      | 0805   |
| 22   | 2.8×2.8mm       | 1111   |
| 31   | 3.2×1.6mm       | 1206   |
| 32   | 3.2×2.5mm       | 1210   |
| 42   | 4.5×2.0mm       | 1808   |
| 43   | 4.5×3.2mm       | 1812   |
| 52   | 5.7×2.8mm       | 2211   |
| 55   | 5.7×5.0mm       | 2220   |

#### ④ Dimension (T)

| Code | Dimension (T)                    |
|------|----------------------------------|
| 2    | 0.2mm                            |
| 2    | 2-elements (Array Type)          |
| 3    | 0.3mm                            |
| 4    | 4-elements (Array Type)          |
| 5    | 0.5mm                            |
| 6    | 0.6mm                            |
| 7    | 0.7mm                            |
| 8    | 0.8mm                            |
| 9    | 0.85mm                           |
| A    | 1.0mm                            |
| B    | 1.25mm                           |
| C    | 1.6mm                            |
| D    | 2.0mm                            |
| E    | 2.5mm                            |
| F    | 3.2mm                            |
| M    | 1.15mm                           |
| N    | 1.35mm                           |
| Q    | 1.5mm                            |
| R    | 1.8mm                            |
| S    | 2.8mm                            |
| X    | Depends on individual standards. |

With the array type GNM series, "Dimension(T)" indicates the number of elements.

Continued on the following page. 

Continued from the preceding page.

## ⑤ Temperature Characteristics

| Temperature Characteristic Codes |                 |     | Temperature Characteristics |                   |                                               | Operating Temperature Range |
|----------------------------------|-----------------|-----|-----------------------------|-------------------|-----------------------------------------------|-----------------------------|
| Code                             | Public STD Code |     | Reference Temperature       | Temperature Range | Capacitance Change or Temperature Coefficient |                             |
| 1X                               | SL *1           | JIS | 20°C                        | 20 to 85°C        | +350 to -1000ppm/°C                           | -55 to 125°C                |
| 2C                               | CH *1           | JIS | 20°C                        | 20 to 125°C       | 0±60ppm/°C                                    | -55 to 125°C                |
| 2P                               | PH *1           | JIS | 20°C                        | 20 to 85°C        | -150±60ppm/°C                                 | -25 to 85°C                 |
| 2R                               | RH *1           | JIS | 20°C                        | 20 to 85°C        | -220±60ppm/°C                                 | -25 to 85°C                 |
| 2S                               | SH *1           | JIS | 20°C                        | 20 to 85°C        | -330±60ppm/°C                                 | -25 to 85°C                 |
| 2T                               | TH *1           | JIS | 20°C                        | 20 to 85°C        | -470±60ppm/°C                                 | -25 to 85°C                 |
| 3C                               | CJ *1           | JIS | 20°C                        | 20 to 125°C       | 0±120ppm/°C                                   | -55 to 125°C                |
| 3P                               | PJ *1           | JIS | 20°C                        | 20 to 85°C        | -150±120ppm/°C                                | -25 to 85°C                 |
| 3R                               | RJ *1           | JIS | 20°C                        | 20 to 85°C        | -220±120ppm/°C                                | -25 to 85°C                 |
| 3S                               | SJ *1           | JIS | 20°C                        | 20 to 85°C        | -330±120ppm/°C                                | -25 to 85°C                 |
| 3T                               | TJ *1           | JIS | 20°C                        | 20 to 85°C        | -470±120ppm/°C                                | -25 to 85°C                 |
| 3U                               | UJ *1           | JIS | 20°C                        | 20 to 85°C        | -750±120ppm/°C                                | -25 to 85°C                 |
| 4C                               | CK *1           | JIS | 20°C                        | 20 to 125°C       | 0±250ppm/°C                                   | -55 to 125°C                |
| 5C                               | C0G *1          | EIA | 25°C                        | 25 to 125°C       | 0±30ppm/°C                                    | -55 to 125°C                |
| 5G                               | X8G *1          | EIA | 25°C                        | 25 to 150°C       | 0±30ppm/°C                                    | -55 to 150°C                |
| 6C                               | C0H *1          | EIA | 25°C                        | 25 to 125°C       | 0±60ppm/°C                                    | -55 to 125°C                |
| 6P                               | P2H *1          | EIA | 25°C                        | 25 to 85°C        | -150±60ppm/°C                                 | -55 to 125°C                |
| 6R                               | R2H *1          | EIA | 25°C                        | 25 to 85°C        | -220±60ppm/°C                                 | -55 to 125°C                |
| 6S                               | S2H *1          | EIA | 25°C                        | 25 to 85°C        | -330±60ppm/°C                                 | -55 to 125°C                |
| 6T                               | T2H *1          | EIA | 25°C                        | 25 to 85°C        | -470±60ppm/°C                                 | -55 to 125°C                |
| 7U                               | U2J *1          | EIA | 25°C                        | 25 to 125°C *6    | -750±120ppm/°C                                | -55 to 125°C                |
| B1                               | B *2            | JIS | 20°C                        | -25 to 85°C       | ±10%                                          | -25 to 85°C                 |
| B3                               | B               | JIS | 20°C                        | -25 to 85°C       | ±10%                                          | -25 to 85°C                 |
| C7                               | X7S             | EIA | 25°C                        | -55 to 125°C      | ±22%                                          | -55 to 125°C                |
| C8                               | X6S             | EIA | 25°C                        | -55 to 105°C      | ±22%                                          | -55 to 105°C                |
| D7                               | X7T             | EIA | 25°C                        | -55 to 125°C      | +22, -33%                                     | -55 to 125°C                |
| D8                               | X6T             | EIA | 25°C                        | -55 to 105°C      | +22, -33%                                     | -55 to 105°C                |
| E7                               | X7U             | EIA | 25°C                        | -55 to 125°C      | +22, -56%                                     | -55 to 125°C                |
| F1                               | F *2            | JIS | 20°C                        | -25 to 85°C       | +30, -80%                                     | -25 to 85°C                 |
| F5                               | Y5V             | EIA | 25°C                        | -30 to 85°C       | +22, -82%                                     | -30 to 85°C                 |
| L8                               | X8L             | *3  | 25°C                        | -55 to 150°C      | +15, -40%                                     | -55 to 150°C                |
| R1                               | R *2            | JIS | 20°C                        | -55 to 125°C      | ±15%                                          | -55 to 125°C                |
| R3                               | R               | JIS | 20°C                        | -55 to 125°C      | ±15%                                          | -55 to 125°C                |
| R6                               | X5R             | EIA | 25°C                        | -55 to 85°C       | ±15%                                          | -55 to 85°C                 |
| R7                               | X7R             | EIA | 25°C                        | -55 to 125°C      | ±15%                                          | -55 to 125°C                |
| R9                               | X8R             | EIA | 25°C                        | -55 to 150°C      | ±15%                                          | -55 to 150°C                |
| W0                               | -               | -   | 25°C                        | -55 to 125°C      | ±10% *4                                       | -55 to 125°C                |
|                                  |                 |     |                             |                   | +22, -33% *5                                  |                             |

\*1 Please refer to table for Capacitance Change under reference temperature.

\*2 Capacitance change is specified with 50% rated voltage applied.

\*3 Murata Temperature Characteristic Code.

\*4 Apply DC350V bias.

\*5 No DC bias.

\*6 Rated Voltage 100Vdc max : 25 to 85°C

Continued on the following page. 

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●Capacitance Change from each temperature

JIS Code

| Murata Code | Capacitance Change from 20°C (%) |       |       |       |       |       |
|-------------|----------------------------------|-------|-------|-------|-------|-------|
|             | -55°C                            |       | -25°C |       | -10°C |       |
|             | Max.                             | Min.  | Max.  | Min.  | Max.  | Min.  |
| 1X          | —                                | —     | —     | —     | —     | —     |
| 2C          | 0.82                             | -0.45 | 0.49  | -0.27 | 0.33  | -0.18 |
| 2P          | —                                | —     | 1.32  | 0.41  | 0.88  | 0.27  |
| 2R          | —                                | —     | 1.70  | 0.72  | 1.13  | 0.48  |
| 2S          | —                                | —     | 2.30  | 1.22  | 1.54  | 0.81  |
| 2T          | —                                | —     | 3.07  | 1.85  | 2.05  | 1.23  |
| 3C          | 1.37                             | -0.90 | 0.82  | -0.54 | 0.55  | -0.36 |
| 3P          | —                                | —     | 1.65  | 0.14  | 1.10  | 0.09  |
| 3R          | —                                | —     | 2.03  | 0.45  | 1.35  | 0.30  |
| 3S          | —                                | —     | 2.63  | 0.95  | 1.76  | 0.63  |
| 3T          | —                                | —     | 3.40  | 1.58  | 2.27  | 1.05  |
| 3U          | —                                | —     | 4.94  | 2.84  | 3.29  | 1.89  |
| 4C          | 2.56                             | -1.88 | 1.54  | -1.13 | 1.02  | -0.75 |

EIA Code

| Murata Code | Capacitance Change from 25°C (%) |       |       |       |       |       |
|-------------|----------------------------------|-------|-------|-------|-------|-------|
|             | -55°C                            |       | -30°C |       | -10°C |       |
|             | Max.                             | Min.  | Max.  | Min.  | Max.  | Min.  |
| 5C/5G       | 0.58                             | -0.24 | 0.40  | -0.17 | 0.25  | -0.11 |
| 6C          | 0.87                             | -0.48 | 0.59  | -0.33 | 0.38  | -0.21 |
| 6P          | 2.33                             | 0.72  | 1.61  | 0.50  | 1.02  | 0.32  |
| 6R          | 3.02                             | 1.28  | 2.08  | 0.88  | 1.32  | 0.56  |
| 6S          | 4.09                             | 2.16  | 2.81  | 1.49  | 1.79  | 0.95  |
| 6T          | 5.46                             | 3.28  | 3.75  | 2.26  | 2.39  | 1.44  |
| 7U          | 8.78                             | 5.04  | 6.04  | 3.47  | 3.84  | 2.21  |

Continued on the following page. 

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#### ⑥ Rated Voltage

| Code      | Rated Voltage                                         |
|-----------|-------------------------------------------------------|
| <b>0E</b> | DC2.5V                                                |
| <b>0G</b> | DC4V                                                  |
| <b>0J</b> | DC6.3V                                                |
| <b>1A</b> | DC10V                                                 |
| <b>1C</b> | DC16V                                                 |
| <b>1E</b> | DC25V                                                 |
| <b>YA</b> | DC35V                                                 |
| <b>1H</b> | DC50V                                                 |
| <b>2A</b> | DC100V                                                |
| <b>2D</b> | DC200V                                                |
| <b>2E</b> | DC250V                                                |
| <b>YD</b> | DC300V                                                |
| <b>2H</b> | DC500V                                                |
| <b>2J</b> | DC630V                                                |
| <b>3A</b> | DC1kV                                                 |
| <b>3D</b> | DC2kV                                                 |
| <b>3F</b> | DC3.15kV                                              |
| <b>BB</b> | DC350V (for Camera Flash Circuit)                     |
| <b>E2</b> | AC250V                                                |
| <b>GB</b> | X2; AC250V (Safety Standard Certified Type GB)        |
| <b>GC</b> | X1/Y2; AC250V (Safety Standard Certified Type GC)     |
| <b>GD</b> | Y3; AC250V (Safety Standard Certified Type GD)        |
| <b>GF</b> | Y2, X1/Y2; AC250V (Safety Standard Certified Type GF) |

#### ⑦ Capacitance

Expressed by three-digit alphanumerics. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two numbers. If there is a decimal point, it is expressed by the capital letter "R". In this case, all figures are significant digits.

Ex.)

| Code       | Capacitance |
|------------|-------------|
| <b>R50</b> | 0.5pF       |
| <b>1R0</b> | 1.0pF       |
| <b>100</b> | 10pF        |
| <b>103</b> | 10000pF     |

Continued on the following page. 

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### ⑧ Capacitance Tolerance

| Code | Capacitance Tolerance            | TC                  | Series      | Capacitance Step        |                         |
|------|----------------------------------|---------------------|-------------|-------------------------|-------------------------|
| W    | ±0.05pF                          | CΔ                  | GRM/GJM     | ≤9.9pF                  | 0.1pF                   |
| B    | ±0.1pF                           | CΔ                  | GRM/GJM     | ≤9.9pF                  | 0.1pF                   |
|      |                                  |                     | GQM         | ≤1pF                    | 0.1pF                   |
|      |                                  |                     |             | 1.1 to 9.9pF            | 1pF Step and E24 Series |
|      |                                  | ERB                 | ≤9.9pF      | 1pF Step and E24 Series |                         |
| C    | ±0.25pF                          | CΔ                  | GRM/GJM     | ≤9.9pF                  | 0.1pF                   |
|      |                                  | except CΔ           | GRM         | ≤5pF                    | * 1pF                   |
|      |                                  | CΔ                  | ERB         | ≤9.9pF                  | 1pF Step and E24 Series |
|      |                                  |                     | GQM         | ≤1pF                    | 0.1pF                   |
|      |                                  |                     |             | 1.1 to 9.9pF            | 1pF Step and E24 Series |
| D    | ±0.5pF                           | CΔ                  | GRM/GJM     | 5.1 to 9.9pF            | 0.1pF                   |
|      |                                  | except CΔ           | GRM         | 5.1 to 9.9pF            | * 1pF                   |
|      |                                  | CΔ                  | ERB/GQM     | 5.1 to 9.9pF            | 1pF Step and E24 Series |
| G    | ±2%                              | CΔ                  | GJM         | ≥10pF                   | E12 Series              |
|      |                                  | CΔ                  | GQM/ERB     | ≥10pF                   | E24 Series              |
| J    | ±5%                              | CΔ-SL               | GRM/GA3     | ≥10pF                   | E12 Series              |
|      |                                  | CΔ                  | ERB/GQM/GJM | ≥10pF                   | E24 Series              |
| K    | ±10%                             | B, R, X7R, X5R, ZLM | GRM/GR7/GA3 | E6 Series               |                         |
|      |                                  | C0G                 | GNM         | E6 Series               |                         |
|      |                                  | B, R, X7R, X5R, ZLM | GR4, GMD    | E12 Series              |                         |
| M    | ±20%                             | B, R, X7R, X7S      | GRM/GMA     | E6 Series               |                         |
|      |                                  | X5R, X7R, X7S       | GNM         | E3 Series               |                         |
|      |                                  | X7R                 | GA2         | E3 Series               |                         |
|      |                                  | X5R, X7R, X7S, X6S  | LLL/LLA/LLM | E3 Series               |                         |
| Z    | +80%, -20%                       | F, Y5V              | GRM         | E3 Series               |                         |
| R    | Depends on individual standards. |                     |             |                         |                         |

\* E24 series is also available.

### ⑨ Individual Specification Code

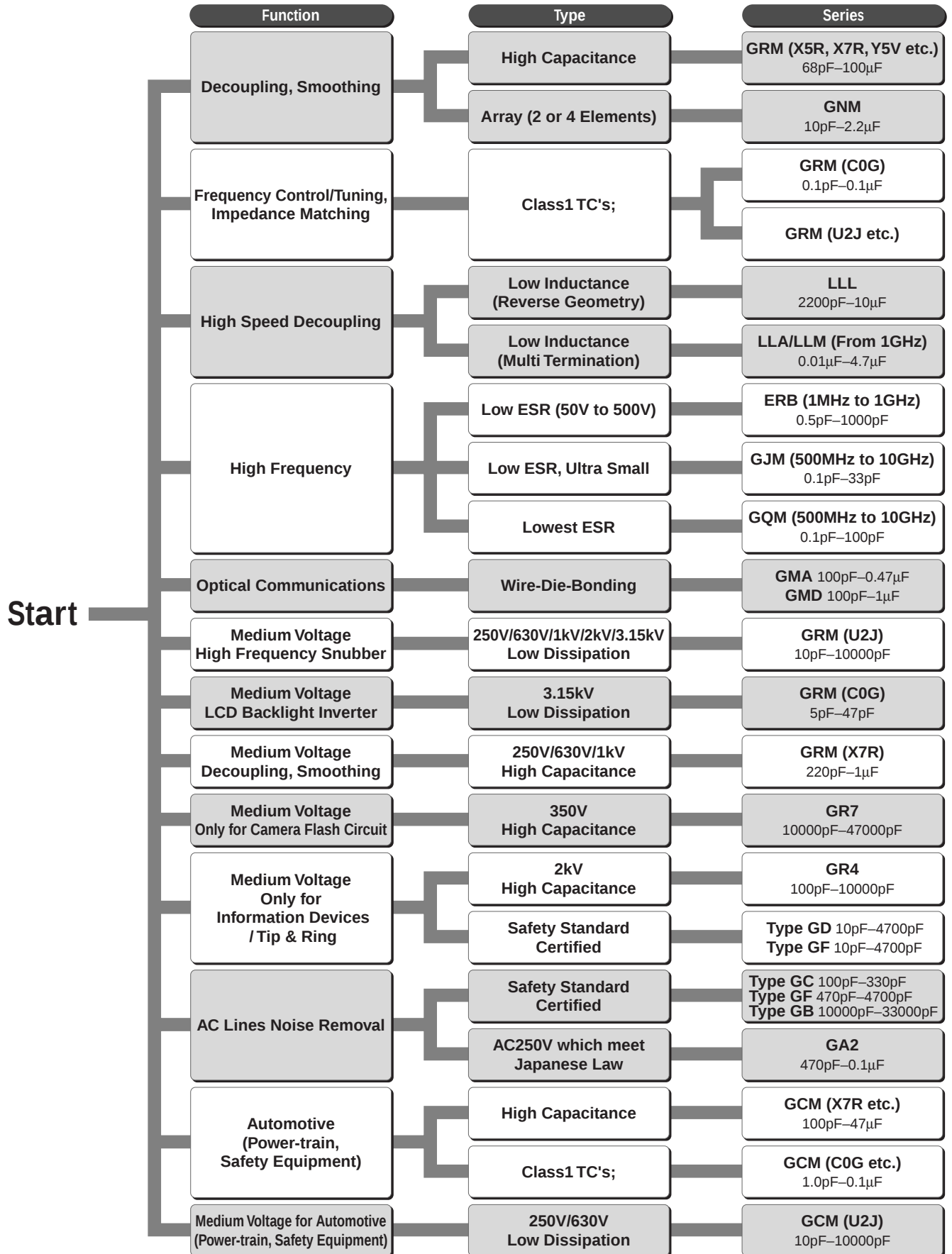
Expressed by three figures.

### ⑩ Packaging

| Code     | Packaging                   |
|----------|-----------------------------|
| <b>L</b> | ø180mm Embossed Taping      |
| <b>D</b> | ø180mm Paper Taping         |
| <b>E</b> | ø180mm Paper Taping (LLL15) |
| <b>K</b> | ø330mm Embossed Taping      |
| <b>J</b> | ø330mm Paper Taping         |
| <b>F</b> | ø330mm Paper Taping (LLL15) |
| <b>B</b> | Bulk                        |
| <b>C</b> | Bulk Case                   |
| <b>T</b> | Bulk Tray                   |

Please check MURATA home page (<http://www.murata.com/index.html>) in case you can not find the part number on the catalog.

## Selection Guide of Chip Monolithic Ceramic Capacitors



# Chip Monolithic Ceramic Capacitors



## for General Purpose GRM Series

### ■ Features

1. Higher resistance of solder-leaching due to the Ni-barriered termination, applicable for reflow-soldering, and flow-soldering (GRM18/21/31 type only).
2. The GRM series is lead free product.
3. Smaller size and higher capacitance value.
4. High reliability and no polarity.
5. Excellent pulse responsibility and noise reduction due to the low impedance at high frequency.
6. The GRM series is available in paper or embossed tape and reel packaging for automatic placement. Bulk case packaging is also available for GRM15/18/21(T=0.6,1.25).
7. Ta replacement.

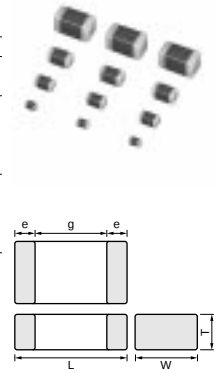
### ■ Applications

General electronic equipment

| Part Number | Dimensions (mm) |           |                  |              |              |
|-------------|-----------------|-----------|------------------|--------------|--------------|
|             | L               | W         | T                | e            | g min.       |
| GRM022      | 0.4 ±0.02       | 0.2 ±0.02 | 0.2 ±0.02        | 0.07 to 0.14 | 0.13         |
| GRM033      | 0.6 ±0.03       | 0.3 ±0.03 | 0.3 ±0.03        | 0.1 to 0.2   | 0.2          |
| GRM15X      |                 |           | 0.25 ±0.05       | 0.1 to 0.3   | 0.4          |
| GRM153      | 1.0 ±0.05       | 0.5 ±0.05 | 0.3 ±0.03        | 0.5 ±0.05    | 0.15 to 0.35 |
| GRM155      |                 |           | 0.5 ±0.05        | 0.15 to 0.35 | 0.3          |
| GRM185      | 1.6 ±0.1        | 0.8 ±0.1  | 0.5 +0/-0.1      | 0.2 to 0.5   | 0.5          |
| GRM188*     |                 |           | 0.8 ±0.1         |              |              |
| GRM216      |                 |           | 0.6 ±0.1         |              |              |
| GRM219      | 2.0 ±0.1        | 1.25 ±0.1 | 0.85 ±0.1        | 0.2 to 0.7   | 0.7          |
| GRM21A      |                 |           | 1.0 +0/-0.2      |              |              |
| GRM21B      |                 |           | 1.25 ±0.1        |              |              |
| GRM316      |                 |           | 0.6 ±0.1         |              |              |
| GRM319      | 3.2 ±0.15       | 1.6 ±0.15 | 0.85 ±0.1        | 0.3 to 0.8   | 1.5          |
| GRM31M      |                 |           | 1.15 ±0.1        |              |              |
| GRM31C      | 3.2 ±0.2        | 1.6 ±0.2  | 1.6 ±0.2         |              |              |
| GRM329      |                 |           | 0.85 +0.15/-0.05 |              |              |
| GRM32A      |                 |           | 1.0 +0/-0.2      |              |              |
| GRM32M      |                 |           | 1.15 ±0.1        |              |              |
| GRM32N      | 3.2 ±0.3        | 2.5 ±0.2  | 1.35 ±0.15       | 0.3 min.     | 1.0          |
| GRM32C      |                 |           | 1.6 ±0.2         |              |              |
| GRM32R      |                 |           | 1.8 ±0.2         |              |              |
| GRM32D      |                 |           | 2.0 ±0.2         |              |              |
| GRM32E      |                 |           | 2.5 ±0.2         |              |              |

\* Bulk Case: 1.6 ±0.07(L) × 0.8 ±0.07(W) × 0.8 ±0.07(T)

\* The figure indicates typical Specification.



## Capacitance Table

1

### Temperature Compensating Type C0G(5C),U2J(7U) Characteristics

| 6           |    | ex.6: T Dimension [mm] |  |                      |         |                     |         |                     |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
|-------------|----|------------------------|--|----------------------|---------|---------------------|---------|---------------------|----------|---------------------|----------|----------------------|----------|---------------------|---------|---------------------|---------|---------------------|---------|---------------------|---------|----------------------|---------|---------------------|---------|
| Capacitance | TC | C0G(5C)                |  |                      |         |                     |         |                     |          |                     |          | U2J(7U)              |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
|             |    | LxW [mm]               |  | 0.4x0.2 (02) <01005> |         | 0.6x0.3 (03) <0201> |         | 1.0x0.5 (15) <0402> |          | 1.6x0.8 (18) <0603> |          | 2.0x1.25 (21) <0805> |          | 3.2x1.6 (31) <1206> |         | 0.6x0.3 (03) <0201> |         | 1.0x0.5 (15) <0402> |         | 1.6x0.8 (18) <0603> |         | 2.0x1.25 (21) <0805> |         | 3.2x1.6 (31) <1206> |         |
|             |    | Rated Voltage [Vdc]    |  | 16 (1C)              | 10 (1A) | 6.3 (0J)            | 50 (1H) | 50 (1H)             | 100 (1E) | 50 (1H)             | 100 (1E) | 50 (1H)              | 100 (1E) | 50 (1H)             | 50 (1H) | 25 (1E)             | 50 (1H) | 10 (1A)             | 50 (1H) | 10 (1A)             | 50 (1H) | 10 (1A)              | 50 (1H) | 10 (1A)             | 50 (1H) |
| 0.1pF(R10)  |    |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.2pF(R20)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.3pF(R30)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.4pF(R40)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.5pF(R50)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.6pF(R60)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.7pF(R70)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.8pF(R80)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 0.9pF(R90)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.0pF(1R0)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     | 3       |                     | 5       |                     |         |                     |         |                      |         |                     |         |
| 1.1pF(1R1)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.2pF(1R2)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.3pF(1R3)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.4pF(1R4)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.5pF(1R5)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.6pF(1R6)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.7pF(1R7)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.8pF(1R8)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 1.9pF(1R9)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.0pF(2R0)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     | 3       |                     | 5       |                     |         |                     |         |                      |         |                     |         |
| 2.1pF(2R1)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.2pF(2R2)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.3pF(2R3)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.4pF(2R4)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.5pF(2R5)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.6pF(2R6)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.7pF(2R7)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.8pF(2R8)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 2.9pF(2R9)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.0pF(3R0)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     | 3       |                     | 5       |                     |         |                     |         |                      |         |                     |         |
| 3.1pF(3R1)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.2pF(3R2)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.3pF(3R3)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.4pF(3R4)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.5pF(3R5)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.6pF(3R6)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.7pF(3R7)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.8pF(3R8)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 3.9pF(3R9)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.0pF(4R0)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     | 3       |                     | 5       |                     |         |                     |         |                      |         |                     |         |
| 4.1pF(4R1)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.2pF(4R2)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.3pF(4R3)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.4pF(4R4)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.5pF(4R5)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.6pF(4R6)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.7pF(4R7)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.8pF(4R8)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |
| 4.9pF(4R9)  | 2  |                        |  |                      |         |                     | 3       | 3, 5                |          |                     |          |                      |          |                     |         |                     |         |                     |         |                     |         |                      |         |                     |         |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

Continued on the following page. 

1

Capacitance Table

 Continued from the preceding page.

| 6           |            | ex.6: T Dimension [mm] |                            |            |             |                           |                           |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|-------------|------------|------------------------|----------------------------|------------|-------------|---------------------------|---------------------------|---------------------------|------------|----------------------------|------------|---------------------------|------------|---------------------------|------------|---------------------------|------------|---------------------------|------------|----------------------------|------------|---------------------------|
| Capacitance | TC         | LxW<br>[mm]            | C0G(5C)                    |            |             |                           |                           |                           |            |                            |            |                           | U2J(7U)    |                           |            |                           |            |                           |            |                            |            |                           |
|             |            |                        | 0.4x0.2<br>(02)<br><01005> |            |             | 0.6x0.3<br>(03)<br><0201> | 1.0x0.5<br>(15)<br><0402> | 1.6x0.8<br>(18)<br><0603> |            | 2.0x1.25<br>(21)<br><0805> |            | 3.2x1.6<br>(31)<br><1206> |            | 0.6x0.3<br>(03)<br><0201> |            | 1.0x0.5<br>(15)<br><0402> |            | 1.6x0.8<br>(18)<br><0603> |            | 2.0x1.25<br>(21)<br><0805> |            | 3.2x1.6<br>(31)<br><1206> |
|             |            |                        | 16<br>(1C)                 | 10<br>(1A) | 6.3<br>(0J) | 50<br>(1H)                | 50<br>(1H)                | 100<br>(1E)               | 50<br>(1H) | 100<br>(1E)                | 50<br>(1H) | 100<br>(1E)               | 50<br>(1H) | 50<br>(1H)                | 25<br>(1E) | 50<br>(1H)                | 10<br>(1A) | 50<br>(1H)                | 10<br>(1A) | 50<br>(1H)                 | 10<br>(1A) | 50<br>(1H)                |
|             | 5.0pF(5R0) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           | 3          |                           | 5          |                           |            |                           |            |                            |            |                           |
|             | 5.1pF(5R1) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.2pF(5R2) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.3pF(5R3) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.4pF(5R4) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.5pF(5R5) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.6pF(5R6) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.7pF(5R7) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.8pF(5R8) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 5.9pF(5R9) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.0pF(6R0) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           | 3          |                           | 5          |                           |            |                           |            |                            |            |                           |
|             | 6.1pF(6R1) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.2pF(6R2) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.3pF(6R3) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.4pF(6R4) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.5pF(6R5) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.6pF(6R6) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.7pF(6R7) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.8pF(6R8) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 6.9pF(6R9) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.0pF(7R0) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           | 3          |                           | 5          |                           |            |                           |            |                            |            |                           |
|             | 7.1pF(7R1) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.2pF(7R2) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.3pF(7R3) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.4pF(7R4) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.5pF(7R5) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.6pF(7R6) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.7pF(7R7) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.8pF(7R8) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 7.9pF(7R9) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.0pF(8R0) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           | 3          |                           | 5          |                           |            |                           |            |                            |            |                           |
|             | 8.1pF(8R1) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.2pF(8R2) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.3pF(8R3) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.4pF(8R4) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.5pF(8R5) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.6pF(8R6) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.7pF(8R7) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.8pF(8R8) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 8.9pF(8R9) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.0pF(9R0) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           | 3          |                           | 5          |                           |            |                           |            |                            |            |                           |
|             | 9.1pF(9R1) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.2pF(9R2) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.3pF(9R3) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.4pF(9R4) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.5pF(9R5) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.6pF(9R6) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.7pF(9R7) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.8pF(9R8) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |
|             | 9.9pF(9R9) | 2                      |                            |            |             | 3                         | 3, 5                      |                           |            |                            |            |                           |            |                           |            |                           |            |                           |            |                            |            |                           |

## 1

**6** ex.6: T Dimension [mm]

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

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Capacitance Table

 Continued from the preceding page.

Temperature Compensating Type P2H(6P),R2H(6R),S2H(6S),T2H(6T) Characteristics

| 6ex. 6: T Dimension [mm] |                     | P2H(6P)           |                   | R2H(6R)           |                   | S2H(6S)           |                   | T2H(6T)           |                   |
|--------------------------|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Capacitance              | TC                  | P2H(6P)           |                   | R2H(6R)           |                   | S2H(6S)           |                   | T2H(6T)           |                   |
|                          | LxW [mm]            | 1.0x0.5(15)<0402> | 0.6x0.3(03)<0201> | 1.0x0.5(15)<0402> | 0.6x0.3(03)<0201> | 1.0x0.5(15)<0402> | 0.6x0.3(03)<0201> | 1.0x0.5(15)<0402> | 0.6x0.3(03)<0201> |
|                          | Rated Voltage [Vdc] | 50(1H)            | 25(1E)            | 50(1H)            | 25(1E)            | 50(1H)            | 25(1E)            | 50(1H)            | 25(1E)            |
| 1.0pF(1R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 2.0pF(2R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 3.0pF(3R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 4.0pF(4R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 5.0pF(5R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 6.0pF(6R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 7.0pF(7R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 8.0pF(8R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 9.0pF(9R0)               |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 10pF(100)                |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 12pF(120)                |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 15pF(150)                |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 18pF(180)                |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 22pF(220)                |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 27pF(270)                |                     | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 33pF(330)                |                     |                   | 3                 | 5                 | 3                 | 5                 | 3                 | 5                 | 3                 |
| 39pF(390)                |                     |                   | 3                 |                   | 3                 | 5                 | 3                 | 5                 | 3                 |
| 47pF(470)                |                     |                   | 3                 |                   | 3                 |                   | 3                 | 5                 | 3                 |
| 56pF(560)                |                     |                   | 3                 |                   | 3                 |                   | 3                 | 5                 | 3                 |
| 68pF(680)                |                     |                   | 3                 |                   | 3                 |                   | 3                 | 5                 | 3                 |
| 82pF(820)                |                     |                   | 3                 |                   | 3                 |                   | 3                 | 5                 | 3                 |
| 100pF(101)               |                     |                   | 3                 |                   | 3                 |                   | 3                 | 5                 | 3                 |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code

Continued on the following page. 

# Capacitance Table

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Continued from the preceding page.

## High Dielectric Constant Type X7R(R7)/X7S(C7)/X7T(D7)/X7U(E7) Characteristics

| 5                   |                             | ex.5: T Dimension [mm]    |            |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            |            |            |             |           |  |
|---------------------|-----------------------------|---------------------------|------------|------------|------------|---------------------------|------------|------------|------------|------------|---------------------------|------------|------------|------------|------------|-------------|-----------|----------------------------|------------|------------|------------|------------|-------------|-----------|--|
| Capacitance         | LxW [mm]<br>(02)<br><01005> | 0.4x0.2<br>(03)<br><0201> |            |            |            | 1.0x0.5<br>(15)<br><0402> |            |            |            |            | 1.6x0.8<br>(18)<br><0603> |            |            |            |            |             |           | 2.0x1.25<br>(21)<br><0805> |            |            |            |            |             |           |  |
|                     |                             | 10<br>(1A)                | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 100<br>(2A)               | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 100<br>(2A)               | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) | 100<br>(2A)                | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) |  |
| Rated Voltage [Vdc] |                             | 2                         |            |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 68pF(680)           |                             | 2                         |            |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 100pF(101)          |                             | 2                         | 3          |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 150pF(151)          |                             | 2                         | 3          |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 220pF(221)          |                             | 2                         | 3          |            |            | 5                         | X, 5       |            |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 330pF(331)          |                             | 2                         | 3          |            |            | 5                         | X, 5       |            |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 470pF(471)          |                             | 2                         | 3          |            |            | 5                         | X, 5       |            |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 680pF(681)          |                             |                           | 3          |            |            | 5                         | X, 5       |            |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 1000pF(102)         |                             |                           | 3          |            |            | 5                         | X, 5       |            |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 1500pF(152)         |                             |                           | 3          |            |            | 5                         | X, 5       |            |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 2200pF(222)         |                             |                           |            | 3          |            | 5                         | 5          | X          |            |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 3300pF(332)         |                             |                           |            | 3          |            | 5                         | 5          |            | X          |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 4700pF(472)         |                             |                           |            |            | 3          | 5                         | 5          | 5          | X          |            | 8                         | 8          |            |            |            |             |           |                            |            |            |            |            |             |           |  |
| 6800pF(682)         |                             |                           |            |            | 3          | 5                         | 5          | 5          | X          |            | 8                         | 8          |            |            |            |             |           | 9                          |            |            |            |            |             |           |  |
| 10000pF(103)        |                             |                           |            |            | 3          | 5                         | 5          | 5          | X          |            | 8                         | 8          | 8          |            |            |             |           | B                          |            |            |            |            |             |           |  |
| 15000pF(153)        |                             |                           |            |            |            | 5                         | 5          | 5          |            |            | 8                         | 8          |            |            |            |             |           | B                          |            |            |            |            |             |           |  |
| 22000pF(223)        |                             |                           |            |            |            | 5                         | 5          | 5          |            |            | 8                         | 8          |            |            |            |             |           | B                          |            |            |            |            |             |           |  |
| 33000pF(333)        |                             |                           |            |            |            |                           | 5          | 5          |            |            | 8                         | 8          |            |            |            |             |           | B                          | 9          |            |            |            |             |           |  |
| 47000pF(473)        |                             |                           |            |            |            |                           | 5          | 5          |            |            | 8                         | 8          |            |            |            |             |           | B                          | B          |            |            |            |             |           |  |
| 68000pF(683)        |                             |                           |            |            |            |                           |            | 5          | 5          |            | 8                         | 8          |            |            |            |             |           |                            | B          | 9          |            |            |             |           |  |
| 0.10μF(104)         |                             |                           |            |            |            |                           | 5          | 5          |            | 8          | 8                         | 8          |            |            |            |             |           |                            | B          | B          |            |            |             |           |  |
| 0.15μF(154)         |                             |                           |            |            |            |                           |            |            |            |            |                           | 8          | 8          |            |            |             |           |                            | B          | B          |            |            |             |           |  |
| 0.22μF(224)         |                             |                           |            |            |            |                           |            |            |            |            |                           | 8          | 8          |            |            |             |           | A                          | B          | B          |            |            |             |           |  |
| 0.33μF(334)         |                             |                           |            |            |            |                           |            |            |            |            |                           |            | 8          | 8          |            |             |           | A                          | 9          | B          |            |            |             |           |  |
| 0.47μF(474)         |                             |                           |            |            |            |                           |            |            |            |            |                           | 8          | 8          | 8          |            |             |           | B                          | B          | 9          |            |            |             |           |  |
| 0.68μF(684)         |                             |                           |            |            |            |                           |            |            |            |            |                           |            |            | 8          |            |             |           |                            |            | 9          | 9          |            |             |           |  |
| 1.0μF(105)          |                             |                           |            |            |            |                           |            |            |            |            | 8                         | 8          | 5, 8       |            |            |             |           | B                          | 9, B       | B          |            |            |             |           |  |
| 2.2μF(225)          |                             |                           |            |            |            |                           |            |            |            |            |                           |            | 8          | 8          | 8          |             |           |                            | B          | B          | B          |            |             |           |  |
| 4.7μF(475)          |                             |                           |            |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            | B          | B          |            |             |           |  |
| 10μF(106)           |                             |                           |            |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            | B          | B          |             |           |  |
| 22μF(226)           |                             |                           |            |            |            |                           |            |            |            |            |                           |            |            |            |            |             |           |                            |            |            |            |            | B           |           |  |

| Capacitance  | LxW [mm] | 3.2x1.6<br>(31)<br><1206> |            |            |            |            |             |           | 3.2x2.5<br>(32)<br><1210> |            |            |            |            |            |             |
|--------------|----------|---------------------------|------------|------------|------------|------------|-------------|-----------|---------------------------|------------|------------|------------|------------|------------|-------------|
|              |          | 100<br>(2A)               | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) | 100<br>(2A)               | 50<br>(1H) | 35<br>(YA) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) |
| 15000pF(153) |          | 9                         |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 22000pF(223) |          | M                         |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 33000pF(333) |          | M                         |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 47000pF(473) |          | M                         |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 68000pF(683) |          | M                         |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.10μF(104)  |          | 9                         |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.15μF(154)  |          | M                         | M          |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.22μF(224)  |          | M                         | M          |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.33μF(334)  |          |                           |            | 9          |            |            |             |           |                           |            |            |            |            |            |             |
| 0.47μF(474)  |          | M                         | M          |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.68μF(684)  |          | M                         | M          |            |            |            |             |           | C                         | N          |            |            |            |            |             |
| 1.0μF(105)   |          | C                         | M          |            |            |            |             |           | C                         |            |            |            |            |            |             |
| 2.2μF(225)   |          |                           | C          | M          | M          |            |             |           | E                         |            |            |            |            |            |             |
| 4.7μF(475)   |          |                           | C          | C          | C          |            |             |           |                           | E          |            |            |            |            |             |
| 10μF(106)    |          |                           |            | C          | C          | C          |             |           |                           |            | E          | D          |            |            |             |
| 22μF(226)    |          |                           |            |            | C          | C          |             |           |                           |            |            | E          | E          |            |             |
| 47μF(476)    |          |                           |            |            |            |            | C           |           |                           |            |            |            |            | E          | E           |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

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Capacitance Table

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High Dielectric Constant Type X6S(C8)/X6T(D8) Characteristics

| 5            |                        | ex.5: T Dimension [mm]    |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
|--------------|------------------------|---------------------------|------------|-------------|-----------|---------------------------|-------------|-----------|-------------|---------------------------|------------|------------|-------------|----------------------------|------------|------------|------------|---------------------------|-----------|------------|------------|---------------------------|---|--|--|
| LxW<br>[mm]  | Rated Voltage<br>[Vdc] | 0.6x0.3<br>(03)<br><0201> |            |             |           | 1.0x0.5<br>(15)<br><0402> |             |           |             | 1.6x0.8<br>(18)<br><0603> |            |            |             | 2.0x1.25<br>(21)<br><0805> |            |            |            | 3.2x1.6<br>(31)<br><1206> |           |            |            | 3.2x2.5<br>(32)<br><1210> |   |  |  |
|              |                        | 6.3<br>(0J)               | 25<br>(1E) | 6.3<br>(0J) | 4<br>(0G) | 10<br>(1A)                | 6.3<br>(0J) | 4<br>(0G) | 2.5<br>(0E) | 25<br>(1E)                | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G)                  | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J)               | 4<br>(0G) | 25<br>(1E) | 10<br>(1A) | 6.3<br>(0J)               |   |  |  |
| Capacitance  |                        |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 15000pF(153) | 3                      |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 22000pF(223) | 3                      |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 33000pF(333) | 3                      |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 47000pF(473) | 3                      |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 68000pF(683) |                        | 5                         |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 0.10μF(104)  |                        | 5                         |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 0.15μF(154)  |                        |                           | 5          | 5           |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 0.22μF(224)  |                        |                           | 5          | 5           |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 0.33μF(334)  |                        |                           | 5          | 5           |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 0.47μF(474)  |                        |                           | 5          | 5           |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 0.68μF(684)  |                        |                           |            | 5           |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 1.0μF(105)   |                        |                           |            |             |           | 5                         | 5           | 8         |             |                           |            | 6          |             |                            |            |            |            |                           |           |            |            |                           |   |  |  |
| 2.2μF(225)   |                        |                           |            |             |           | 8                         | 8           |           |             |                           |            | 9          |             |                            |            | 6          |            |                           |           |            |            |                           |   |  |  |
| 4.7μF(475)   |                        |                           |            |             |           |                           |             | 8         |             | B                         | B          | 9          | 9           |                            |            | 9          |            |                           |           |            |            |                           |   |  |  |
| 10μF(106)    |                        |                           |            |             |           |                           |             |           | 8           |                           |            | B          | 9, B        | 9                          | C          |            |            |                           |           |            | D          |                           |   |  |  |
| 22μF(226)    |                        |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            | C          | C                         |           |            | E          |                           |   |  |  |
| 47μF(476)    |                        |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            | C                         | C         |            |            | E                         | E |  |  |
| 100μF(107)   |                        |                           |            |             |           |                           |             |           |             |                           |            |            |             |                            |            |            |            |                           | C         |            |            |                           |   |  |  |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code

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# Capacitance Table

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## High Dielectric Constant Type X5R(R6) Characteristics

| 5            |          | ex.5: T Dimension [mm]     |             | : Please refer to X7R(R7) etc Characteristics. |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
|--------------|----------|----------------------------|-------------|------------------------------------------------|------------|------------|-------------|---------------------------|------------|------------|------------|------------|-------------|-----------|-------------|---------------------------|------------|------------|------------|-------------|-----------|--|--|
| Capacitance  | LxW [mm] | 0.4x0.2<br>(02)<br><01005> |             | 0.6x0.3<br>(03)<br><0201>                      |            |            |             | 1.0x0.5<br>(15)<br><0402> |            |            |            |            |             |           |             | 1.6x0.8<br>(18)<br><0603> |            |            |            |             |           |  |  |
|              |          | 10<br>(1A)                 | 6.3<br>(0J) | 25<br>(1E)                                     | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 100<br>(2A)               | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) | 100<br>(2A) | 50<br>(1H)                | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) |  |  |
| 68pF(680)    |          | 2                          |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 100pF(101)   |          | 2                          |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 150pF(151)   |          | 2                          |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 220pF(221)   |          | 2                          |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 330pF(331)   |          | 2                          |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 470pF(471)   |          | 2                          |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 680pF(681)   |          |                            | 2           |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 1000pF(102)  |          |                            | 2           |                                                |            |            |             |                           | 5          |            |            |            |             |           |             | 8                         |            |            |            |             |           |  |  |
| 1500pF(152)  |          |                            | 2           |                                                |            |            | 3           |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 2200pF(222)  |          |                            | 2           |                                                |            |            | 3           |                           |            | 5          |            |            |             |           |             | 8                         |            |            |            |             |           |  |  |
| 3300pF(332)  |          |                            | 2           |                                                |            |            | 3           |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 4700pF(472)  |          |                            | 2           |                                                |            |            | 3           |                           |            | 5          |            |            |             |           |             | 8                         |            |            |            |             |           |  |  |
| 6800pF(682)  |          |                            | 2           |                                                |            |            | 3           |                           |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 10000pF(103) |          |                            | 2           |                                                |            |            | 3           |                           |            |            |            |            |             |           |             | 8                         |            |            |            |             |           |  |  |
| 15000pF(153) |          |                            |             |                                                |            |            |             | 3                         |            |            |            |            |             |           |             |                           |            |            |            |             |           |  |  |
| 22000pF(223) |          |                            |             |                                                |            |            |             | 3                         |            |            |            | 5          |             |           |             | 8                         |            |            |            |             |           |  |  |
| 33000pF(333) |          |                            |             |                                                |            |            |             | 3                         |            |            |            |            | 5           | 5         |             |                           |            |            |            |             |           |  |  |
| 47000pF(473) |          |                            |             |                                                |            |            |             | 3                         |            |            |            |            |             | 5         | 5           |                           |            |            |            |             |           |  |  |
| 68000pF(683) |          |                            |             |                                                |            |            |             |                           |            | 5          | 5          | 5          |             |           |             |                           |            |            |            |             |           |  |  |
| 0.10μF(104)  |          |                            |             |                                                |            |            |             |                           |            | 5          | 5          | 5          |             |           |             | 8                         | 8          |            |            |             |           |  |  |
| 0.15μF(154)  |          |                            |             |                                                |            |            |             |                           |            |            |            | 5          | 5           |           |             |                           |            |            | 8          |             |           |  |  |
| 0.22μF(224)  |          |                            |             |                                                |            |            |             |                           |            |            |            |            | 5           | 5         |             |                           | 8          | 8          | 8          |             |           |  |  |
| 0.33μF(334)  |          |                            |             |                                                |            |            |             |                           |            |            |            |            |             | 5         | 5           |                           |            |            |            |             |           |  |  |
| 0.47μF(474)  |          |                            |             |                                                |            |            |             |                           |            |            |            |            |             | 5         | 5           |                           |            | 8          | 8          | 8           |           |  |  |
| 0.68μF(684)  |          |                            |             |                                                |            |            |             |                           |            |            |            |            |             | 5         | 5           |                           |            |            |            |             |           |  |  |
| 1.0μF(105)   |          |                            |             |                                                |            |            |             |                           |            |            |            |            | 5           |           |             |                           | 8          | 5, 8       | 5          |             |           |  |  |
| 2.2μF(225)   |          |                            |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            | 8          | 8          |             |           |  |  |
| 4.7μF(475)   |          |                            |             |                                                |            |            |             |                           |            |            |            |            |             |           | 5           |                           |            |            |            |             | 8         |  |  |
| 10μF(106)    |          |                            |             |                                                |            |            |             |                           |            |            |            |            |             |           |             |                           |            |            |            |             | 8         |  |  |

| Capacitance  | LxW [mm] | 2.0x1.25<br>(21)<br><0805> |            |            |            |            |             |           | 3.2x1.6<br>(31)<br><1206> |            |            |            |            |             |           | 3.2x2.5<br>(32)<br><1210> |            |            |            |            |            |             |
|--------------|----------|----------------------------|------------|------------|------------|------------|-------------|-----------|---------------------------|------------|------------|------------|------------|-------------|-----------|---------------------------|------------|------------|------------|------------|------------|-------------|
|              |          | 100<br>(2A)                | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) | 100<br>(2A)               | 50<br>(1H) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) | 4<br>(0G) | 100<br>(2A)               | 50<br>(1H) | 35<br>(YA) | 25<br>(1E) | 16<br>(1C) | 10<br>(1A) | 6.3<br>(0J) |
| 6800pF(682)  |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 10000pF(103) |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 15000pF(153) |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 22000pF(223) |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 33000pF(333) |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 47000pF(473) |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 68000pF(683) |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.10μF(104)  |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.15μF(154)  |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.22μF(224)  |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.33μF(334)  |          |                            |            |            |            | B          |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.47μF(474)  |          |                            |            |            |            | B          |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 0.68μF(684)  |          |                            |            |            |            |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 1.0μF(105)   |          |                            |            | 6          | B          |            |             |           |                           |            |            |            |            |             |           |                           |            |            |            |            |            |             |
| 2.2μF(225)   |          |                            |            | 9, B       | 9, B       | B          |             |           |                           |            | C          | 6          |            |             |           |                           |            |            |            |            |            |             |
| 4.7μF(475)   |          |                            |            | B          | 9, B       | 9          |             |           |                           |            | 9, C       | 9, C       |            |             |           |                           |            |            |            |            |            |             |
| 10μF(106)    |          |                            |            |            | B          | 9, B       | 9           |           |                           |            | C          | 9, C       | 9          |             |           |                           |            | E          | D          |            |            |             |
| 22μF(226)    |          |                            |            |            |            |            | B           | 9         |                           |            |            | C          | C          |             |           |                           |            |            | E          |            |            |             |
| 47μF(476)    |          |                            |            |            |            |            |             |           |                           |            |            |            |            | C           |           |                           |            |            |            | E          | E          |             |
| 100μF(107)   |          |                            |            |            |            |            |             |           |                           |            |            |            |            | C           | C         |                           |            |            |            |            |            |             |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 0.1pF(R10)        | ±0.05pF(W) |                    | GRM0335C1HR10WD01D | GRM1555C1HR10WA01D |
|                   | ±0.1pF(B)  |                    | GRM0335C1HR10BD01D | GRM1555C1HR10BA01D |
| 0.2pF(R20)        | ±0.05pF(W) | GRM0225C1CR20WD05L | GRM0335C1HR20WD01D | GRM1555C1HR20WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR20BD05L | GRM0335C1HR20BD01D | GRM1555C1HR20BA01D |
| 0.3pF(R30)        | ±0.05pF(W) | GRM0225C1CR30WD05L | GRM0335C1HR30WD01D | GRM1555C1HR30WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR30BD05L | GRM0335C1HR30BD01D | GRM1555C1HR30BA01D |
| 0.4pF(R40)        | ±0.05pF(W) | GRM0225C1CR40WD05L | GRM0335C1HR40WD01D | GRM1555C1HR40WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR40BD05L | GRM0335C1HR40BD01D | GRM1555C1HR40BA01D |
| 0.5pF(R50)        | ±0.05pF(W) | GRM0225C1CR50WD05L | GRM0335C1HR50WD01D | GRM1555C1HR50WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR50BD05L | GRM0335C1HR50BD01D | GRM1555C1HR50BA01D |
| 0.6pF(R60)        | ±0.05pF(W) | GRM0225C1CR60WD05L | GRM0335C1HR60WD01D | GRM1555C1HR60WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR60BD05L | GRM0335C1HR60BD01D | GRM1555C1HR60BA01D |
| 0.7pF(R70)        | ±0.05pF(W) | GRM0225C1CR70WD05L | GRM0335C1HR70WD01D | GRM1555C1HR70WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR70BD05L | GRM0335C1HR70BD01D | GRM1555C1HR70BA01D |
| 0.8pF(R80)        | ±0.05pF(W) | GRM0225C1CR80WD05L | GRM0335C1HR80WD01D | GRM1555C1HR80WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR80BD05L | GRM0335C1HR80BD01D | GRM1555C1HR80BA01D |
| 0.9pF(R90)        | ±0.05pF(W) | GRM0225C1CR90WD05L | GRM0335C1HR90WD01D | GRM1555C1HR90WA01D |
|                   | ±0.1pF(B)  | GRM0225C1CR90BD05L | GRM0335C1HR90BD01D | GRM1555C1HR90BA01D |
| 1.0pF(1R0)        | ±0.05pF(W) | GRM0225C1C1R0WD05L | GRM0335C1H1R0WD01D | GRM1555C1H1R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R0BD05L | GRM0335C1H1R0BD01D | GRM1555C1H1R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R0CD05L | GRM0335C1H1R0CD01D | GRM1555C1H1R0CA01D |
| 1.1pF(1R1)        | ±0.05pF(W) | GRM0225C1C1R1WD05L | GRM0335C1H1R1WD01D | GRM1555C1H1R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R1BD05L | GRM0335C1H1R1BD01D | GRM1555C1H1R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R1CD05L | GRM0335C1H1R1CD01D | GRM1555C1H1R1CA01D |
| 1.2pF(1R2)        | ±0.05pF(W) | GRM0225C1C1R2WD05L | GRM0335C1H1R2WD01D | GRM1555C1H1R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R2BD05L | GRM0335C1H1R2BD01D | GRM1555C1H1R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R2CD05L | GRM0335C1H1R2CD01D | GRM1555C1H1R2CA01D |
| 1.3pF(1R3)        | ±0.05pF(W) | GRM0225C1C1R3WD05L | GRM0335C1H1R3WD01D | GRM1555C1H1R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R3BD05L | GRM0335C1H1R3BD01D | GRM1555C1H1R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R3CD05L | GRM0335C1H1R3CD01D | GRM1555C1H1R3CA01D |
| 1.4pF(1R4)        | ±0.05pF(W) | GRM0225C1C1R4WD05L | GRM0335C1H1R4WD01D | GRM1555C1H1R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R4BD05L | GRM0335C1H1R4BD01D | GRM1555C1H1R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R4CD05L | GRM0335C1H1R4CD01D | GRM1555C1H1R4CA01D |
| 1.5pF(1R5)        | ±0.05pF(W) | GRM0225C1C1R5WD05L | GRM0335C1H1R5WD01D | GRM1555C1H1R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R5BD05L | GRM0335C1H1R5BD01D | GRM1555C1H1R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R5CD05L | GRM0335C1H1R5CD01D | GRM1555C1H1R5CA01D |
| 1.6pF(1R6)        | ±0.05pF(W) | GRM0225C1C1R6WD05L | GRM0335C1H1R6WD01D | GRM1555C1H1R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R6BD05L | GRM0335C1H1R6BD01D | GRM1555C1H1R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R6CD05L | GRM0335C1H1R6CD01D | GRM1555C1H1R6CA01D |
| 1.7pF(1R7)        | ±0.05pF(W) | GRM0225C1C1R7WD05L | GRM0335C1H1R7WD01D | GRM1555C1H1R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R7BD05L | GRM0335C1H1R7BD01D | GRM1555C1H1R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R7CD05L | GRM0335C1H1R7CD01D | GRM1555C1H1R7CA01D |
| 1.8pF(1R8)        | ±0.05pF(W) | GRM0225C1C1R8WD05L | GRM0335C1H1R8WD01D | GRM1555C1H1R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R8BD05L | GRM0335C1H1R8BD01D | GRM1555C1H1R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R8CD05L | GRM0335C1H1R8CD01D | GRM1555C1H1R8CA01D |
| 1.9pF(1R9)        | ±0.05pF(W) | GRM0225C1C1R9WD05L | GRM0335C1H1R9WD01D | GRM1555C1H1R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C1R9BD05L | GRM0335C1H1R9BD01D | GRM1555C1H1R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C1R9CD05L | GRM0335C1H1R9CD01D | GRM1555C1H1R9CA01D |
| 2.0pF(2R0)        | ±0.05pF(W) | GRM0225C1C2R0WD05L | GRM0335C1H2R0WD01D | GRM1555C1H2R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R0BD05L | GRM0335C1H2R0BD01D | GRM1555C1H2R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R0CD05L | GRM0335C1H2R0CD01D | GRM1555C1H2R0CA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **02** **2** **5C** **1C** **R20** **W** **D05** **L** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging\*

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

\*GRM022: D is applicable.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 2.1pF(2R1)        | ±0.05pF(W) | GRM0225C1C2R1WD05L | GRM0335C1H2R1WD01D | GRM1555C1H2R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R1BD05L | GRM0335C1H2R1BD01D | GRM1555C1H2R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R1CD05L | GRM0335C1H2R1CD01D | GRM1555C1H2R1CA01D |
| 2.2pF(2R2)        | ±0.05pF(W) | GRM0225C1C2R2WD05L | GRM0335C1H2R2WD01D | GRM1555C1H2R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R2BD05L | GRM0335C1H2R2BD01D | GRM1555C1H2R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R2CD05L | GRM0335C1H2R2CD01D | GRM1555C1H2R2CA01D |
| 2.3pF(2R3)        | ±0.05pF(W) | GRM0225C1C2R3WD05L | GRM0335C1H2R3WD01D | GRM1555C1H2R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R3BD05L | GRM0335C1H2R3BD01D | GRM1555C1H2R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R3CD05L | GRM0335C1H2R3CD01D | GRM1555C1H2R3CA01D |
| 2.4pF(2R4)        | ±0.05pF(W) | GRM0225C1C2R4WD05L | GRM0335C1H2R4WD01D | GRM1555C1H2R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R4BD05L | GRM0335C1H2R4BD01D | GRM1555C1H2R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R4CD05L | GRM0335C1H2R4CD01D | GRM1555C1H2R4CA01D |
| 2.5pF(2R5)        | ±0.05pF(W) | GRM0225C1C2R5WD05L | GRM0335C1H2R5WD01D | GRM1555C1H2R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R5BD05L | GRM0335C1H2R5BD01D | GRM1555C1H2R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R5CD05L | GRM0335C1H2R5CD01D | GRM1555C1H2R5CA01D |
| 2.6pF(2R6)        | ±0.05pF(W) | GRM0225C1C2R6WD05L | GRM0335C1H2R6WD01D | GRM1555C1H2R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R6BD05L | GRM0335C1H2R6BD01D | GRM1555C1H2R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R6CD05L | GRM0335C1H2R6CD01D | GRM1555C1H2R6CA01D |
| 2.7pF(2R7)        | ±0.05pF(W) | GRM0225C1C2R7WD05L | GRM0335C1H2R7WD01D | GRM1555C1H2R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R7BD05L | GRM0335C1H2R7BD01D | GRM1555C1H2R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R7CD05L | GRM0335C1H2R7CD01D | GRM1555C1H2R7CA01D |
| 2.8pF(2R8)        | ±0.05pF(W) | GRM0225C1C2R8WD05L | GRM0335C1H2R8WD01D | GRM1555C1H2R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R8BD05L | GRM0335C1H2R8BD01D | GRM1555C1H2R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R8CD05L | GRM0335C1H2R8CD01D | GRM1555C1H2R8CA01D |
| 2.9pF(2R9)        | ±0.05pF(W) | GRM0225C1C2R9WD05L | GRM0335C1H2R9WD01D | GRM1555C1H2R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C2R9BD05L | GRM0335C1H2R9BD01D | GRM1555C1H2R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C2R9CD05L | GRM0335C1H2R9CD01D | GRM1555C1H2R9CA01D |
| 3.0pF(3R0)        | ±0.05pF(W) | GRM0225C1C3R0WD05L | GRM0335C1H3R0WD01D | GRM1555C1H3R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R0BD05L | GRM0335C1H3R0BD01D | GRM1555C1H3R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R0CD05L | GRM0335C1H3R0CD01D | GRM1555C1H3R0CA01D |
| 3.1pF(3R1)        | ±0.05pF(W) | GRM0225C1C3R1WD05L | GRM0335C1H3R1WD01D | GRM1555C1H3R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R1BD05L | GRM0335C1H3R1BD01D | GRM1555C1H3R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R1CD05L | GRM0335C1H3R1CD01D | GRM1555C1H3R1CA01D |
| 3.2pF(3R2)        | ±0.05pF(W) | GRM0225C1C3R2WD05L | GRM0335C1H3R2WD01D | GRM1555C1H3R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R2BD05L | GRM0335C1H3R2BD01D | GRM1555C1H3R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R2CD05L | GRM0335C1H3R2CD01D | GRM1555C1H3R2CA01D |
| 3.3pF(3R3)        | ±0.05pF(W) | GRM0225C1C3R3WD05L | GRM0335C1H3R3WD01D | GRM1555C1H3R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R3BD05L | GRM0335C1H3R3BD01D | GRM1555C1H3R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R3CD05L | GRM0335C1H3R3CD01D | GRM1555C1H3R3CA01D |
| 3.4pF(3R4)        | ±0.05pF(W) | GRM0225C1C3R4WD05L | GRM0335C1H3R4WD01D | GRM1555C1H3R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R4BD05L | GRM0335C1H3R4BD01D | GRM1555C1H3R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R4CD05L | GRM0335C1H3R4CD01D | GRM1555C1H3R4CA01D |
| 3.5pF(3R5)        | ±0.05pF(W) | GRM0225C1C3R5WD05L | GRM0335C1H3R5WD01D | GRM1555C1H3R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R5BD05L | GRM0335C1H3R5BD01D | GRM1555C1H3R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R5CD05L | GRM0335C1H3R5CD01D | GRM1555C1H3R5CA01D |
| 3.6pF(3R6)        | ±0.05pF(W) | GRM0225C1C3R6WD05L | GRM0335C1H3R6WD01D | GRM1555C1H3R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R6BD05L | GRM0335C1H3R6BD01D | GRM1555C1H3R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R6CD05L | GRM0335C1H3R6CD01D | GRM1555C1H3R6CA01D |
| 3.7pF(3R7)        | ±0.05pF(W) | GRM0225C1C3R7WD05L | GRM0335C1H3R7WD01D | GRM1555C1H3R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R7BD05L | GRM0335C1H3R7BD01D | GRM1555C1H3R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R7CD05L | GRM0335C1H3R7CD01D | GRM1555C1H3R7CA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 3.8pF(3R8)        | ±0.05pF(W) | GRM0225C1C3R8WD05L | GRM0335C1H3R8WD01D | GRM1555C1H3R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R8BD05L | GRM0335C1H3R8BD01D | GRM1555C1H3R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R8CD05L | GRM0335C1H3R8CD01D | GRM1555C1H3R8CA01D |
| 3.9pF(3R9)        | ±0.05pF(W) | GRM0225C1C3R9WD05L | GRM0335C1H3R9WD01D | GRM1555C1H3R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C3R9BD05L | GRM0335C1H3R9BD01D | GRM1555C1H3R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C3R9CD05L | GRM0335C1H3R9CD01D | GRM1555C1H3R9CA01D |
| 4.0pF(4R0)        | ±0.05pF(W) | GRM0225C1C4R0WD05L | GRM0335C1H4R0WD01D | GRM1555C1H4R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R0BD05L | GRM0335C1H4R0BD01D | GRM1555C1H4R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R0CD05L | GRM0335C1H4R0CD01D | GRM1555C1H4R0CA01D |
| 4.1pF(4R1)        | ±0.05pF(W) | GRM0225C1C4R1WD05L | GRM0335C1H4R1WD01D | GRM1555C1H4R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R1BD05L | GRM0335C1H4R1BD01D | GRM1555C1H4R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R1CD05L | GRM0335C1H4R1CD01D | GRM1555C1H4R1CA01D |
| 4.2pF(4R2)        | ±0.05pF(W) | GRM0225C1C4R2WD05L | GRM0335C1H4R2WD01D | GRM1555C1H4R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R2BD05L | GRM0335C1H4R2BD01D | GRM1555C1H4R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R2CD05L | GRM0335C1H4R2CD01D | GRM1555C1H4R2CA01D |
| 4.3pF(4R3)        | ±0.05pF(W) | GRM0225C1C4R3WD05L | GRM0335C1H4R3WD01D | GRM1555C1H4R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R3BD05L | GRM0335C1H4R3BD01D | GRM1555C1H4R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R3CD05L | GRM0335C1H4R3CD01D | GRM1555C1H4R3CA01D |
| 4.4pF(4R4)        | ±0.05pF(W) | GRM0225C1C4R4WD05L | GRM0335C1H4R4WD01D | GRM1555C1H4R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R4BD05L | GRM0335C1H4R4BD01D | GRM1555C1H4R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R4CD05L | GRM0335C1H4R4CD01D | GRM1555C1H4R4CA01D |
| 4.5pF(4R5)        | ±0.05pF(W) | GRM0225C1C4R5WD05L | GRM0335C1H4R5WD01D | GRM1555C1H4R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R5BD05L | GRM0335C1H4R5BD01D | GRM1555C1H4R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R5CD05L | GRM0335C1H4R5CD01D | GRM1555C1H4R5CA01D |
| 4.6pF(4R6)        | ±0.05pF(W) | GRM0225C1C4R6WD05L | GRM0335C1H4R6WD01D | GRM1555C1H4R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R6BD05L | GRM0335C1H4R6BD01D | GRM1555C1H4R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R6CD05L | GRM0335C1H4R6CD01D | GRM1555C1H4R6CA01D |
| 4.7pF(4R7)        | ±0.05pF(W) | GRM0225C1C4R7WD05L | GRM0335C1H4R7WD01D | GRM1555C1H4R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R7BD05L | GRM0335C1H4R7BD01D | GRM1555C1H4R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R7CD05L | GRM0335C1H4R7CD01D | GRM1555C1H4R7CA01D |
| 4.8pF(4R8)        | ±0.05pF(W) | GRM0225C1C4R8WD05L | GRM0335C1H4R8WD01D | GRM1555C1H4R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R8BD05L | GRM0335C1H4R8BD01D | GRM1555C1H4R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R8CD05L | GRM0335C1H4R8CD01D | GRM1555C1H4R8CA01D |
| 4.9pF(4R9)        | ±0.05pF(W) | GRM0225C1C4R9WD05L | GRM0335C1H4R9WD01D | GRM1555C1H4R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C4R9BD05L | GRM0335C1H4R9BD01D | GRM1555C1H4R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C4R9CD05L | GRM0335C1H4R9CD01D | GRM1555C1H4R9CA01D |
| 5.0pF(5R0)        | ±0.05pF(W) | GRM0225C1C5R0WD05L | GRM0335C1H5R0WD01D | GRM1555C1H5R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R0BD05L | GRM0335C1H5R0BD01D | GRM1555C1H5R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R0CD05L | GRM0335C1H5R0CD01D | GRM1555C1H5R0CA01D |
| 5.1pF(5R1)        | ±0.05pF(W) | GRM0225C1C5R1WD05L | GRM0335C1H5R1WD01D | GRM1555C1H5R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R1BD05L | GRM0335C1H5R1BD01D | GRM1555C1H5R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R1CD05L | GRM0335C1H5R1CD01D | GRM1555C1H5R1CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R1DD05L | GRM0335C1H5R1DD01D | GRM1555C1H5R1DA01D |
| 5.2pF(5R2)        | ±0.05pF(W) | GRM0225C1C5R2WD05L | GRM0335C1H5R2WD01D | GRM1555C1H5R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R2BD05L | GRM0335C1H5R2BD01D | GRM1555C1H5R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R2CD05L | GRM0335C1H5R2CD01D | GRM1555C1H5R2CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R2DD05L | GRM0335C1H5R2DD01D | GRM1555C1H5R2DA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **02** **2** **5C** **1C** **3R8** **W** **D05** **L**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging\*

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

\*GRM022: D is applicable.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 5.3pF(5R3)        | ±0.05pF(W) | GRM0225C1C5R3WD05L | GRM0335C1H5R3WD01D | GRM1555C1H5R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R3BD05L | GRM0335C1H5R3BD01D | GRM1555C1H5R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R3CD05L | GRM0335C1H5R3CD01D | GRM1555C1H5R3CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R3DD05L | GRM0335C1H5R3DD01D | GRM1555C1H5R3DA01D |
| 5.4pF(5R4)        | ±0.05pF(W) | GRM0225C1C5R4WD05L | GRM0335C1H5R4WD01D | GRM1555C1H5R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R4BD05L | GRM0335C1H5R4BD01D | GRM1555C1H5R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R4CD05L | GRM0335C1H5R4CD01D | GRM1555C1H5R4CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R4DD05L | GRM0335C1H5R4DD01D | GRM1555C1H5R4DA01D |
| 5.5pF(5R5)        | ±0.05pF(W) | GRM0225C1C5R5WD05L | GRM0335C1H5R5WD01D | GRM1555C1H5R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R5BD05L | GRM0335C1H5R5BD01D | GRM1555C1H5R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R5CD05L | GRM0335C1H5R5CD01D | GRM1555C1H5R5CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R5DD05L | GRM0335C1H5R5DD01D | GRM1555C1H5R5DA01D |
| 5.6pF(5R6)        | ±0.05pF(W) | GRM0225C1C5R6WD05L | GRM0335C1H5R6WD01D | GRM1555C1H5R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R6BD05L | GRM0335C1H5R6BD01D | GRM1555C1H5R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R6CD05L | GRM0335C1H5R6CD01D | GRM1555C1H5R6CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R6DD05L | GRM0335C1H5R6DD01D | GRM1555C1H5R6DA01D |
| 5.7pF(5R7)        | ±0.05pF(W) | GRM0225C1C5R7WD05L | GRM0335C1H5R7WD01D | GRM1555C1H5R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R7BD05L | GRM0335C1H5R7BD01D | GRM1555C1H5R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R7CD05L | GRM0335C1H5R7CD01D | GRM1555C1H5R7CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R7DD05L | GRM0335C1H5R7DD01D | GRM1555C1H5R7DA01D |
| 5.8pF(5R8)        | ±0.05pF(W) | GRM0225C1C5R8WD05L | GRM0335C1H5R8WD01D | GRM1555C1H5R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R8BD05L | GRM0335C1H5R8BD01D | GRM1555C1H5R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R8CD05L | GRM0335C1H5R8CD01D | GRM1555C1H5R8CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R8DD05L | GRM0335C1H5R8DD01D | GRM1555C1H5R8DA01D |
| 5.9pF(5R9)        | ±0.05pF(W) | GRM0225C1C5R9WD05L | GRM0335C1H5R9WD01D | GRM1555C1H5R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C5R9BD05L | GRM0335C1H5R9BD01D | GRM1555C1H5R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C5R9CD05L | GRM0335C1H5R9CD01D | GRM1555C1H5R9CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C5R9DD05L | GRM0335C1H5R9DD01D | GRM1555C1H5R9DA01D |
| 6.0pF(6R0)        | ±0.05pF(W) | GRM0225C1C6R0WD05L | GRM0335C1H6R0WD01D | GRM1555C1H6R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R0BD05L | GRM0335C1H6R0BD01D | GRM1555C1H6R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R0CD05L | GRM0335C1H6R0CD01D | GRM1555C1H6R0CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R0DD05L | GRM0335C1H6R0DD01D | GRM1555C1H6R0DA01D |
| 6.1pF(6R1)        | ±0.05pF(W) | GRM0225C1C6R1WD05L | GRM0335C1H6R1WD01D | GRM1555C1H6R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R1BD05L | GRM0335C1H6R1BD01D | GRM1555C1H6R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R1CD05L | GRM0335C1H6R1CD01D | GRM1555C1H6R1CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R1DD05L | GRM0335C1H6R1DD01D | GRM1555C1H6R1DA01D |
| 6.2pF(6R2)        | ±0.05pF(W) | GRM0225C1C6R2WD05L | GRM0335C1H6R2WD01D | GRM1555C1H6R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R2BD05L | GRM0335C1H6R2BD01D | GRM1555C1H6R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R2CD05L | GRM0335C1H6R2CD01D | GRM1555C1H6R2CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R2DD05L | GRM0335C1H6R2DD01D | GRM1555C1H6R2DA01D |
| 6.3pF(6R3)        | ±0.05pF(W) | GRM0225C1C6R3WD05L | GRM0335C1H6R3WD01D | GRM1555C1H6R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R3BD05L | GRM0335C1H6R3BD01D | GRM1555C1H6R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R3CD05L | GRM0335C1H6R3CD01D | GRM1555C1H6R3CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R3DD05L | GRM0335C1H6R3DD01D | GRM1555C1H6R3DA01D |
| 6.4pF(6R4)        | ±0.05pF(W) | GRM0225C1C6R4WD05L | GRM0335C1H6R4WD01D | GRM1555C1H6R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R4BD05L | GRM0335C1H6R4BD01D | GRM1555C1H6R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R4CD05L | GRM0335C1H6R4CD01D | GRM1555C1H6R4CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R4DD05L | GRM0335C1H6R4DD01D | GRM1555C1H6R4DA01D |
| 6.5pF(6R5)        | ±0.05pF(W) | GRM0225C1C6R5WD05L | GRM0335C1H6R5WD01D | GRM1555C1H6R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R5BD05L | GRM0335C1H6R5BD01D | GRM1555C1H6R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R5CD05L | GRM0335C1H6R5CD01D | GRM1555C1H6R5CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R5DD05L | GRM0335C1H6R5DD01D | GRM1555C1H6R5DA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 6.6pF(6R6)        | ±0.05pF(W) | GRM0225C1C6R6WD05L | GRM0335C1H6R6WD01D | GRM1555C1H6R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R6BD05L | GRM0335C1H6R6BD01D | GRM1555C1H6R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R6CD05L | GRM0335C1H6R6CD01D | GRM1555C1H6R6CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R6DD05L | GRM0335C1H6R6DD01D | GRM1555C1H6R6DA01D |
| 6.7pF(6R7)        | ±0.05pF(W) | GRM0225C1C6R7WD05L | GRM0335C1H6R7WD01D | GRM1555C1H6R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R7BD05L | GRM0335C1H6R7BD01D | GRM1555C1H6R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R7CD05L | GRM0335C1H6R7CD01D | GRM1555C1H6R7CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R7DD05L | GRM0335C1H6R7DD01D | GRM1555C1H6R7DA01D |
| 6.8pF(6R8)        | ±0.05pF(W) | GRM0225C1C6R8WD05L | GRM0335C1H6R8WD01D | GRM1555C1H6R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R8BD05L | GRM0335C1H6R8BD01D | GRM1555C1H6R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R8CD05L | GRM0335C1H6R8CD01D | GRM1555C1H6R8CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R8DD05L | GRM0335C1H6R8DD01D | GRM1555C1H6R8DA01D |
| 6.9pF(6R9)        | ±0.05pF(W) | GRM0225C1C6R9WD05L | GRM0335C1H6R9WD01D | GRM1555C1H6R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C6R9BD05L | GRM0335C1H6R9BD01D | GRM1555C1H6R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C6R9CD05L | GRM0335C1H6R9CD01D | GRM1555C1H6R9CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C6R9DD05L | GRM0335C1H6R9DD01D | GRM1555C1H6R9DA01D |
| 7.0pF(7R0)        | ±0.05pF(W) | GRM0225C1C7R0WD05L | GRM0335C1H7R0WD01D | GRM1555C1H7R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R0BD05L | GRM0335C1H7R0BD01D | GRM1555C1H7R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R0CD05L | GRM0335C1H7R0CD01D | GRM1555C1H7R0CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R0DD05L | GRM0335C1H7R0DD01D | GRM1555C1H7R0DA01D |
| 7.1pF(7R1)        | ±0.05pF(W) | GRM0225C1C7R1WD05L | GRM0335C1H7R1WD01D | GRM1555C1H7R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R1BD05L | GRM0335C1H7R1BD01D | GRM1555C1H7R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R1CD05L | GRM0335C1H7R1CD01D | GRM1555C1H7R1CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R1DD05L | GRM0335C1H7R1DD01D | GRM1555C1H7R1DA01D |
| 7.2pF(7R2)        | ±0.05pF(W) | GRM0225C1C7R2WD05L | GRM0335C1H7R2WD01D | GRM1555C1H7R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R2BD05L | GRM0335C1H7R2BD01D | GRM1555C1H7R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R2CD05L | GRM0335C1H7R2CD01D | GRM1555C1H7R2CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R2DD05L | GRM0335C1H7R2DD01D | GRM1555C1H7R2DA01D |
| 7.3pF(7R3)        | ±0.05pF(W) | GRM0225C1C7R3WD05L | GRM0335C1H7R3WD01D | GRM1555C1H7R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R3BD05L | GRM0335C1H7R3BD01D | GRM1555C1H7R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R3CD05L | GRM0335C1H7R3CD01D | GRM1555C1H7R3CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R3DD05L | GRM0335C1H7R3DD01D | GRM1555C1H7R3DA01D |
| 7.4pF(7R4)        | ±0.05pF(W) | GRM0225C1C7R4WD05L | GRM0335C1H7R4WD01D | GRM1555C1H7R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R4BD05L | GRM0335C1H7R4BD01D | GRM1555C1H7R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R4CD05L | GRM0335C1H7R4CD01D | GRM1555C1H7R4CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R4DD05L | GRM0335C1H7R4DD01D | GRM1555C1H7R4DA01D |
| 7.5pF(7R5)        | ±0.05pF(W) | GRM0225C1C7R5WD05L | GRM0335C1H7R5WD01D | GRM1555C1H7R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R5BD05L | GRM0335C1H7R5BD01D | GRM1555C1H7R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R5CD05L | GRM0335C1H7R5CD01D | GRM1555C1H7R5CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R5DD05L | GRM0335C1H7R5DD01D | GRM1555C1H7R5DA01D |
| 7.6pF(7R6)        | ±0.05pF(W) | GRM0225C1C7R6WD05L | GRM0335C1H7R6WD01D | GRM1555C1H7R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R6BD05L | GRM0335C1H7R6BD01D | GRM1555C1H7R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R6CD05L | GRM0335C1H7R6CD01D | GRM1555C1H7R6CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R6DD05L | GRM0335C1H7R6DD01D | GRM1555C1H7R6DA01D |
| 7.7pF(7R7)        | ±0.05pF(W) | GRM0225C1C7R7WD05L | GRM0335C1H7R7WD01D | GRM1555C1H7R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R7BD05L | GRM0335C1H7R7BD01D | GRM1555C1H7R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R7CD05L | GRM0335C1H7R7CD01D | GRM1555C1H7R7CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R7DD05L | GRM0335C1H7R7DD01D | GRM1555C1H7R7DA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **02** **2** **5C** **1C** **6R6** **W** **D05** **L** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging\*

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

\*GRM022: D is applicable.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 7.8pF(7R8)        | ±0.05pF(W) | GRM0225C1C7R8WD05L | GRM0335C1H7R8WD01D | GRM1555C1H7R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R8BD05L | GRM0335C1H7R8BD01D | GRM1555C1H7R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R8CD05L | GRM0335C1H7R8CD01D | GRM1555C1H7R8CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R8DD05L | GRM0335C1H7R8DD01D | GRM1555C1H7R8DA01D |
| 7.9pF(7R9)        | ±0.05pF(W) | GRM0225C1C7R9WD05L | GRM0335C1H7R9WD01D | GRM1555C1H7R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C7R9BD05L | GRM0335C1H7R9BD01D | GRM1555C1H7R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C7R9CD05L | GRM0335C1H7R9CD01D | GRM1555C1H7R9CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C7R9DD05L | GRM0335C1H7R9DD01D | GRM1555C1H7R9DA01D |
| 8.0pF(8R0)        | ±0.05pF(W) | GRM0225C1C8R0WD05L | GRM0335C1H8R0WD01D | GRM1555C1H8R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R0BD05L | GRM0335C1H8R0BD01D | GRM1555C1H8R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R0CD05L | GRM0335C1H8R0CD01D | GRM1555C1H8R0CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R0DD05L | GRM0335C1H8R0DD01D | GRM1555C1H8R0DA01D |
| 8.1pF(8R1)        | ±0.05pF(W) | GRM0225C1C8R1WD05L | GRM0335C1H8R1WD01D | GRM1555C1H8R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R1BD05L | GRM0335C1H8R1BD01D | GRM1555C1H8R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R1CD05L | GRM0335C1H8R1CD01D | GRM1555C1H8R1CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R1DD05L | GRM0335C1H8R1DD01D | GRM1555C1H8R1DA01D |
| 8.2pF(8R2)        | ±0.05pF(W) | GRM0225C1C8R2WD05L | GRM0335C1H8R2WD01D | GRM1555C1H8R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R2BD05L | GRM0335C1H8R2BD01D | GRM1555C1H8R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R2CD05L | GRM0335C1H8R2CD01D | GRM1555C1H8R2CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R2DD05L | GRM0335C1H8R2DD01D | GRM1555C1H8R2DA01D |
| 8.3pF(8R3)        | ±0.05pF(W) | GRM0225C1C8R3WD05L | GRM0335C1H8R3WD01D | GRM1555C1H8R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R3BD05L | GRM0335C1H8R3BD01D | GRM1555C1H8R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R3CD05L | GRM0335C1H8R3CD01D | GRM1555C1H8R3CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R3DD05L | GRM0335C1H8R3DD01D | GRM1555C1H8R3DA01D |
| 8.4pF(8R4)        | ±0.05pF(W) | GRM0225C1C8R4WD05L | GRM0335C1H8R4WD01D | GRM1555C1H8R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R4BD05L | GRM0335C1H8R4BD01D | GRM1555C1H8R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R4CD05L | GRM0335C1H8R4CD01D | GRM1555C1H8R4CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R4DD05L | GRM0335C1H8R4DD01D | GRM1555C1H8R4DA01D |
| 8.5pF(8R5)        | ±0.05pF(W) | GRM0225C1C8R5WD05L | GRM0335C1H8R5WD01D | GRM1555C1H8R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R5BD05L | GRM0335C1H8R5BD01D | GRM1555C1H8R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R5CD05L | GRM0335C1H8R5CD01D | GRM1555C1H8R5CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R5DD05L | GRM0335C1H8R5DD01D | GRM1555C1H8R5DA01D |
| 8.6pF(8R6)        | ±0.05pF(W) | GRM0225C1C8R6WD05L | GRM0335C1H8R6WD01D | GRM1555C1H8R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R6BD05L | GRM0335C1H8R6BD01D | GRM1555C1H8R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R6CD05L | GRM0335C1H8R6CD01D | GRM1555C1H8R6CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R6DD05L | GRM0335C1H8R6DD01D | GRM1555C1H8R6DA01D |
| 8.7pF(8R7)        | ±0.05pF(W) | GRM0225C1C8R7WD05L | GRM0335C1H8R7WD01D | GRM1555C1H8R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R7BD05L | GRM0335C1H8R7BD01D | GRM1555C1H8R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R7CD05L | GRM0335C1H8R7CD01D | GRM1555C1H8R7CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R7DD05L | GRM0335C1H8R7DD01D | GRM1555C1H8R7DA01D |
| 8.8pF(8R8)        | ±0.05pF(W) | GRM0225C1C8R8WD05L | GRM0335C1H8R8WD01D | GRM1555C1H8R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R8BD05L | GRM0335C1H8R8BD01D | GRM1555C1H8R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R8CD05L | GRM0335C1H8R8CD01D | GRM1555C1H8R8CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R8DD05L | GRM0335C1H8R8DD01D | GRM1555C1H8R8DA01D |
| 8.9pF(8R9)        | ±0.05pF(W) | GRM0225C1C8R9WD05L | GRM0335C1H8R9WD01D | GRM1555C1H8R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C8R9BD05L | GRM0335C1H8R9BD01D | GRM1555C1H8R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C8R9CD05L | GRM0335C1H8R9CD01D | GRM1555C1H8R9CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C8R9DD05L | GRM0335C1H8R9DD01D | GRM1555C1H8R9DA01D |
| 9.0pF(9R0)        | ±0.05pF(W) | GRM0225C1C9R0WD05L | GRM0335C1H9R0WD01D | GRM1555C1H9R0WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R0BD05L | GRM0335C1H9R0BD01D | GRM1555C1H9R0BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R0CD05L | GRM0335C1H9R0CD01D | GRM1555C1H9R0CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R0DD05L | GRM0335C1H9R0DD01D | GRM1555C1H9R0DA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.4x0.2(02)<01005> | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 16(1C)             | 50(1H)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 9.1pF(9R1)        | ±0.05pF(W) | GRM0225C1C9R1WD05L | GRM0335C1H9R1WD01D | GRM1555C1H9R1WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R1BD05L | GRM0335C1H9R1BD01D | GRM1555C1H9R1BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R1CD05L | GRM0335C1H9R1CD01D | GRM1555C1H9R1CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R1DD05L | GRM0335C1H9R1DD01D | GRM1555C1H9R1DA01D |
| 9.2pF(9R2)        | ±0.05pF(W) | GRM0225C1C9R2WD05L | GRM0335C1H9R2WD01D | GRM1555C1H9R2WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R2BD05L | GRM0335C1H9R2BD01D | GRM1555C1H9R2BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R2CD05L | GRM0335C1H9R2CD01D | GRM1555C1H9R2CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R2DD05L | GRM0335C1H9R2DD01D | GRM1555C1H9R2DA01D |
| 9.3pF(9R3)        | ±0.05pF(W) | GRM0225C1C9R3WD05L | GRM0335C1H9R3WD01D | GRM1555C1H9R3WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R3BD05L | GRM0335C1H9R3BD01D | GRM1555C1H9R3BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R3CD05L | GRM0335C1H9R3CD01D | GRM1555C1H9R3CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R3DD05L | GRM0335C1H9R3DD01D | GRM1555C1H9R3DA01D |
| 9.4pF(9R4)        | ±0.05pF(W) | GRM0225C1C9R4WD05L | GRM0335C1H9R4WD01D | GRM1555C1H9R4WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R4BD05L | GRM0335C1H9R4BD01D | GRM1555C1H9R4BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R4CD05L | GRM0335C1H9R4CD01D | GRM1555C1H9R4CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R4DD05L | GRM0335C1H9R4DD01D | GRM1555C1H9R4DA01D |
| 9.5pF(9R5)        | ±0.05pF(W) | GRM0225C1C9R5WD05L | GRM0335C1H9R5WD01D | GRM1555C1H9R5WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R5BD05L | GRM0335C1H9R5BD01D | GRM1555C1H9R5BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R5CD05L | GRM0335C1H9R5CD01D | GRM1555C1H9R5CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R5DD05L | GRM0335C1H9R5DD01D | GRM1555C1H9R5DA01D |
| 9.6pF(9R6)        | ±0.05pF(W) | GRM0225C1C9R6WD05L | GRM0335C1H9R6WD01D | GRM1555C1H9R6WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R6BD05L | GRM0335C1H9R6BD01D | GRM1555C1H9R6BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R6CD05L | GRM0335C1H9R6CD01D | GRM1555C1H9R6CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R6DD05L | GRM0335C1H9R6DD01D | GRM1555C1H9R6DA01D |
| 9.7pF(9R7)        | ±0.05pF(W) | GRM0225C1C9R7WD05L | GRM0335C1H9R7WD01D | GRM1555C1H9R7WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R7BD05L | GRM0335C1H9R7BD01D | GRM1555C1H9R7BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R7CD05L | GRM0335C1H9R7CD01D | GRM1555C1H9R7CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R7DD05L | GRM0335C1H9R7DD01D | GRM1555C1H9R7DA01D |
| 9.8pF(9R8)        | ±0.05pF(W) | GRM0225C1C9R8WD05L | GRM0335C1H9R8WD01D | GRM1555C1H9R8WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R8BD05L | GRM0335C1H9R8BD01D | GRM1555C1H9R8BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R8CD05L | GRM0335C1H9R8CD01D | GRM1555C1H9R8CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R8DD05L | GRM0335C1H9R8DD01D | GRM1555C1H9R8DA01D |
| 9.9pF(9R9)        | ±0.05pF(W) | GRM0225C1C9R9WD05L | GRM0335C1H9R9WD01D | GRM1555C1H9R9WA01D |
|                   | ±0.1pF(B)  | GRM0225C1C9R9BD05L | GRM0335C1H9R9BD01D | GRM1555C1H9R9BA01D |
|                   | ±0.25pF(C) | GRM0225C1C9R9CD05L | GRM0335C1H9R9CD01D | GRM1555C1H9R9CA01D |
|                   | ±0.5pF(D)  | GRM0225C1C9R9DD05L | GRM0335C1H9R9DD01D | GRM1555C1H9R9DA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **02** **2** **5C** **1C** **9R1** **W** **D05** **L** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging\*  
 Packaging Code in Part Number is a code shows STD 180mm Reel Taping. \*GRM022: D is applicable.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 0.4x0.2(02)<01005> |                    |                    | 0.6x0.3(03)<0201>  |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 16(1C)             | 10(1A)             | 6.3(0J)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10pF(100)         | ±2%(G)    | GRM0225C1C100GD05L |                    |                    | GRM0335C1H100GD01D |
|                   | ±5%(J)    | GRM0225C1C100JD05L |                    |                    | GRM0335C1H100JD01D |
| 12pF(120)         | ±2%(G)    | GRM0225C1C120GD05L |                    |                    | GRM0335C1H120GD01D |
|                   | ±5%(J)    | GRM0225C1C120JD05L |                    |                    | GRM0335C1H120JD01D |
| 15pF(150)         | ±2%(G)    | GRM0225C1C150GD05L |                    |                    | GRM0335C1H150GD01D |
|                   | ±5%(J)    | GRM0225C1C150JD05L |                    |                    | GRM0335C1H150JD01D |
| 18pF(180)         | ±2%(G)    | GRM0225C1C180GD05L |                    |                    | GRM0335C1H180GD01D |
|                   | ±5%(J)    | GRM0225C1C180JD05L |                    |                    | GRM0335C1H180JD01D |
| 22pF(220)         | ±2%(G)    | GRM0225C1C220GD05L |                    |                    | GRM0335C1H220GD01D |
|                   | ±5%(J)    | GRM0225C1C220JD05L |                    |                    | GRM0335C1H220JD01D |
| 27pF(270)         | ±2%(G)    | GRM0225C1C270GD05L |                    |                    | GRM0335C1H270GD01D |
|                   | ±5%(J)    | GRM0225C1C270JD05L |                    |                    | GRM0335C1H270JD01D |
| 33pF(330)         | ±2%(G)    | GRM0225C1C330GD05L |                    |                    | GRM0335C1H330GD01D |
|                   | ±5%(J)    | GRM0225C1C330JD05L |                    |                    | GRM0335C1H330JD01D |
| 39pF(390)         | ±2%(G)    | GRM0225C1C390GD05L |                    |                    | GRM0335C1H390GD01D |
|                   | ±5%(J)    | GRM0225C1C390JD05L |                    |                    | GRM0335C1H390JD01D |
| 47pF(470)         | ±2%(G)    | GRM0225C1C470GD05L |                    |                    | GRM0335C1H470GD01D |
|                   | ±5%(J)    | GRM0225C1C470JD05L |                    |                    | GRM0335C1H470JD01D |
| 56pF(560)         | ±2%(G)    |                    | GRM0225C1A560GD05L | GRM0225C0J560GD05L | GRM0335C1H560GD01D |
|                   | ±5%(J)    |                    | GRM0225C1A560JD05L | GRM0225C0J560JD05L | GRM0335C1H560JD01D |
| 68pF(680)         | ±2%(G)    |                    | GRM0225C1A680GD05L | GRM0225C0J680GD05L | GRM0335C1H680GD01D |
|                   | ±5%(J)    |                    | GRM0225C1A680JD05L | GRM0225C0J680JD05L | GRM0335C1H680JD01D |
| 82pF(820)         | ±2%(G)    |                    | GRM0225C1A820GD05L | GRM0225C0J820GD05L | GRM0335C1H820GD01D |
|                   | ±5%(J)    |                    | GRM0225C1A820JD05L | GRM0225C0J820JD05L | GRM0335C1H820JD01D |
| 100pF(101)        | ±2%(G)    |                    | GRM0225C1A101GD05L | GRM0225C0J101GD05L | GRM0335C1H101GD01D |
|                   | ±5%(J)    |                    | GRM0225C1A101JD05L | GRM0225C0J101JD05L | GRM0335C1H101JD01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             |
| TC                |           | C0G(5C)            |
| Capacitance       | Tolerance | Part Number        |
| 10pF(100)         | ±2%(G)    | GRM1555C1H100GA01D |
|                   | ±5%(J)    | GRM1555C1H100JA01D |
| 12pF(120)         | ±2%(G)    | GRM1555C1H120GA01D |
|                   | ±5%(J)    | GRM1555C1H120JA01D |
| 15pF(150)         | ±2%(G)    | GRM1555C1H150GA01D |
|                   | ±5%(J)    | GRM1555C1H150JA01D |
| 18pF(180)         | ±2%(G)    | GRM1555C1H180GA01D |
|                   | ±5%(J)    | GRM1555C1H180JA01D |
| 22pF(220)         | ±2%(G)    | GRM1555C1H220GA01D |
|                   | ±5%(J)    | GRM1555C1H220JA01D |
| 27pF(270)         | ±2%(G)    | GRM1555C1H270GA01D |
|                   | ±5%(J)    | GRM1555C1H270JA01D |
| 33pF(330)         | ±2%(G)    | GRM1555C1H330GA01D |
|                   | ±5%(J)    | GRM1555C1H330JA01D |
| 39pF(390)         | ±2%(G)    | GRM1555C1H390GA01D |
|                   | ±5%(J)    | GRM1555C1H390JA01D |
| 47pF(470)         | ±2%(G)    | GRM1555C1H470GA01D |
|                   | ±5%(J)    | GRM1555C1H470JA01D |
| 56pF(560)         | ±2%(G)    | GRM1555C1H560GA01D |
|                   | ±5%(J)    | GRM1555C1H560JA01D |
| 68pF(680)         | ±2%(G)    | GRM1555C1H680GA01D |
|                   | ±5%(J)    | GRM1555C1H680JA01D |
| 82pF(820)         | ±2%(G)    | GRM1555C1H820GA01D |
|                   | ±5%(J)    | GRM1555C1H820JA01D |
| 100pF(101)        | ±2%(G)    | GRM1555C1H101GA01D |
|                   | ±5%(J)    | GRM1555C1H101JA01D |
| 120pF(121)        | ±2%(G)    | GRM1555C1H121GA01D |
|                   | ±5%(J)    | GRM1555C1H121JA01D |
| 150pF(151)        | ±2%(G)    | GRM1555C1H151GA01D |
|                   | ±5%(J)    | GRM1555C1H151JA01D |
| 180pF(181)        | ±2%(G)    | GRM1555C1H181GA01D |
|                   | ±5%(J)    | GRM1555C1H181JA01D |
| 220pF(221)        | ±2%(G)    | GRM1555C1H221GA01D |
|                   | ±5%(J)    | GRM1555C1H221JA01D |
| 270pF(271)        | ±2%(G)    | GRM1555C1H271GA01D |
|                   | ±5%(J)    | GRM1555C1H271JA01D |
| 330pF(331)        | ±2%(G)    | GRM1555C1H331GA01D |
|                   | ±5%(J)    | GRM1555C1H331JA01D |
| 390pF(391)        | ±2%(G)    | GRM1555C1H391GA01D |
|                   | ±5%(J)    | GRM1555C1H391JA01D |
| 470pF(471)        | ±2%(G)    | GRM1555C1H471GA01D |
|                   | ±5%(J)    | GRM1555C1H471JA01D |
| 560pF(561)        | ±2%(G)    | GRM1555C1H561GA01D |
|                   | ±5%(J)    | GRM1555C1H561JA01D |
| 680pF(681)        | ±2%(G)    | GRM1555C1H681GA01D |
|                   | ±5%(J)    | GRM1555C1H681JA01D |
| 820pF(821)        | ±2%(G)    | GRM1555C1H821GA01D |
|                   | ±5%(J)    | GRM1555C1H821JA01D |
| 1000pF(102)       | ±2%(G)    | GRM1555C1H102GA01D |
|                   | ±5%(J)    | GRM1555C1H102JA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **15** **5** **5C** **1H** **100** **G** **Z01** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

①Product ID ②Series  
 ⑤Temperature Characteristics  
 ⑧Capacitance Tolerance

③Dimension (LxW)  
 ⑥Rated Voltage  
 ⑨Individual Specification Code

④Dimension (T)  
 ⑦Capacitance  
 ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603>  |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |
| 10pF(100)         | ±5%(J)    | GRM1885C2A100JA01D | GRM1885C1H100JA01D |
| 12pF(120)         | ±5%(J)    | GRM1885C2A120JA01D | GRM1885C1H120JA01D |
| 15pF(150)         | ±5%(J)    | GRM1885C2A150JA01D | GRM1885C1H150JA01D |
| 18pF(180)         | ±5%(J)    | GRM1885C2A180JA01D | GRM1885C1H180JA01D |
| 22pF(220)         | ±5%(J)    | GRM1885C2A220JA01D | GRM1885C1H220JA01D |
| 27pF(270)         | ±5%(J)    | GRM1885C2A270JA01D | GRM1885C1H270JA01D |
| 33pF(330)         | ±5%(J)    | GRM1885C2A330JA01D | GRM1885C1H330JA01D |
| 39pF(390)         | ±5%(J)    | GRM1885C2A390JA01D | GRM1885C1H390JA01D |
| 47pF(470)         | ±5%(J)    | GRM1885C2A470JA01D | GRM1885C1H470JA01D |
| 56pF(560)         | ±5%(J)    | GRM1885C2A560JA01D | GRM1885C1H560JA01D |
| 68pF(680)         | ±5%(J)    | GRM1885C2A680JA01D | GRM1885C1H680JA01D |
| 82pF(820)         | ±5%(J)    | GRM1885C2A820JA01D | GRM1885C1H820JA01D |
| 100pF(101)        | ±5%(J)    | GRM1885C2A101JA01D | GRM1885C1H101JA01D |
| 120pF(121)        | ±5%(J)    | GRM1885C2A121JA01D | GRM1885C1H121JA01D |
| 150pF(151)        | ±5%(J)    | GRM1885C2A151JA01D | GRM1885C1H151JA01D |
| 180pF(181)        | ±5%(J)    | GRM1885C2A181JA01D | GRM1885C1H181JA01D |
| 220pF(221)        | ±5%(J)    | GRM1885C2A221JA01D | GRM1885C1H221JA01D |
| 270pF(271)        | ±5%(J)    | GRM1885C2A271JA01D | GRM1885C1H271JA01D |
| 330pF(331)        | ±5%(J)    | GRM1885C2A331JA01D | GRM1885C1H331JA01D |
| 390pF(391)        | ±5%(J)    | GRM1885C2A391JA01D | GRM1885C1H391JA01D |
| 470pF(471)        | ±5%(J)    | GRM1885C2A471JA01D | GRM1885C1H471JA01D |
| 560pF(561)        | ±5%(J)    | GRM1885C2A561JA01D | GRM1885C1H561JA01D |
| 680pF(681)        | ±5%(J)    | GRM1885C2A681JA01D | GRM1885C1H681JA01D |
| 820pF(821)        | ±5%(J)    | GRM1885C2A821JA01D | GRM1885C1H821JA01D |
| 1000pF(102)       | ±5%(J)    | GRM1885C2A102JA01D | GRM1885C1H102JA01D |
| 1200pF(122)       | ±5%(J)    | GRM1885C2A122JA01D | GRM1885C1H122JA01D |
| 1500pF(152)       | ±5%(J)    | GRM1885C2A152JA01D | GRM1885C1H152JA01D |
| 1800pF(182)       | ±5%(J)    |                    | GRM1885C1H182JA01D |
| 2200pF(222)       | ±5%(J)    |                    | GRM1885C1H222JA01D |
| 2700pF(272)       | ±5%(J)    |                    | GRM1885C1H272JA01D |
| 3300pF(332)       | ±5%(J)    |                    | GRM1885C1H332JA01D |
| 3900pF(392)       | ±5%(J)    |                    | GRM1885C1H392JA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    | 3.2x1.6(31)<1206>  |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 100pF(101)        | ±5%(J)    | GRM2165C2A101JA01D |                    |                    |                    |
| 120pF(121)        | ±5%(J)    | GRM2165C2A121JA01D |                    |                    |                    |
| 150pF(151)        | ±5%(J)    | GRM2165C2A151JA01D |                    |                    |                    |
| 180pF(181)        | ±5%(J)    | GRM2165C2A181JA01D |                    |                    |                    |
| 220pF(221)        | ±5%(J)    | GRM2165C2A221JA01D |                    |                    |                    |
| 270pF(271)        | ±5%(J)    | GRM2165C2A271JA01D |                    |                    |                    |
| 330pF(331)        | ±5%(J)    | GRM2165C2A331JA01D |                    |                    |                    |
| 390pF(391)        | ±5%(J)    | GRM2165C2A391JA01D |                    |                    |                    |
| 470pF(471)        | ±5%(J)    | GRM2165C2A471JA01D |                    |                    |                    |
| 560pF(561)        | ±5%(J)    | GRM2165C2A561JA01D |                    |                    |                    |
| 680pF(681)        | ±5%(J)    | GRM2165C2A681JA01D |                    |                    |                    |
| 820pF(821)        | ±5%(J)    | GRM2165C2A821JA01D |                    |                    |                    |
| 1000pF(102)       | ±5%(J)    | GRM2165C2A102JA01D |                    |                    |                    |
| 1200pF(122)       | ±5%(J)    | GRM2165C2A122JA01D | GRM2165C1H122JA01D |                    |                    |
| 1500pF(152)       | ±5%(J)    | GRM2165C2A152JA01D | GRM2165C1H152JA01D |                    |                    |
| 1800pF(182)       | ±5%(J)    | GRM2165C2A182JA01D | GRM2165C1H182JA01D | GRM3195C2A182JA01D |                    |
| 2200pF(222)       | ±5%(J)    | GRM2165C2A222JA01D | GRM2165C1H222JA01D | GRM3195C2A222JA01D |                    |
| 2700pF(272)       | ±5%(J)    | GRM2165C2A272JA01D | GRM2165C1H272JA01D | GRM3195C2A272JA01D |                    |
| 3300pF(332)       | ±5%(J)    | GRM2165C2A332JA01D | GRM2165C1H332JA01D | GRM3195C2A332JA01D |                    |
| 3900pF(392)       | ±5%(J)    |                    | GRM2165C1H392JA01D | GRM3195C2A392JA01D |                    |
| 4700pF(472)       | ±5%(J)    |                    | GRM2165C1H472JA01D | GRM3195C2A472JA01D | GRM3195C1H472JA01D |
| 5600pF(562)       | ±5%(J)    |                    | GRM2195C1H562JA01D | GRM3195C2A562JA01D | GRM3195C1H562JA01D |
| 6800pF(682)       | ±5%(J)    |                    | GRM2195C1H682JA01D | GRM3195C2A682JA01D | GRM3195C1H682JA01D |
| 8200pF(822)       | ±5%(J)    |                    | GRM2195C1H822JA01D | GRM3195C2A822JA01D | GRM3195C1H822JA01D |
| 10000pF(103)      | ±5%(J)    |                    | GRM2195C1H103JA01D | GRM3195C2A103JA01D | GRM3195C1H103JA01D |
| 12000pF(123)      | ±5%(J)    |                    | GRM2195C1H123JA01D |                    | GRM3195C1H123JA01D |
| 15000pF(153)      | ±5%(J)    |                    | GRM2195C1H153JA01D |                    | GRM3195C1H153JA01D |
| 18000pF(183)      | ±5%(J)    |                    | GRM21B5C1H183JA01L |                    | GRM3195C1H183JA01D |
| 22000pF(223)      | ±5%(J)    |                    | GRM21B5C1H223JA01L |                    | GRM3195C1H223JA01D |
| 27000pF(273)      | ±5%(J)    |                    |                    |                    | GRM3195C1H273JA01D |
| 33000pF(333)      | ±5%(J)    |                    |                    |                    | GRM3195C1H333JA01D |
| 39000pF(393)      | ±5%(J)    |                    |                    |                    | GRM3195C1H393JA01D |
| 47000pF(473)      | ±5%(J)    |                    |                    |                    | GRM31M5C1H473JA01L |
| 56000pF(563)      | ±5%(J)    |                    |                    |                    | GRM31M5C1H563JA01L |
| 68000pF(683)      | ±5%(J)    |                    |                    |                    | GRM31C5C1H683JA01L |
| 82000pF(823)      | ±5%(J)    |                    |                    |                    | GRM31C5C1H823JA01L |
| 100000pF(104)     | ±5%(J)    |                    |                    |                    | GRM31C5C1H104JA01L |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code

(Part Number) GRM2165C2A101JA01D

①Product ID

②Series

③Dimension (LxW)

④Dimension (T)

⑤Temperature Characteristics

⑥Rated Voltage

⑦Capacitance

⑧Capacitance Tolerance

⑨Individual Specification Code

⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics Low Profile

| LxW [mm]          |            | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|
| Rated Volt. [Vdc] |            | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |
| 0.1pF(R10)        | ±0.1pF(B)  | GRM1535C1HR10BDD5D |
| 0.2pF(R20)        | ±0.1pF(B)  | GRM1535C1HR20BDD5D |
| 0.3pF(R30)        | ±0.1pF(B)  | GRM1535C1HR30BDD5D |
| 0.4pF(R40)        | ±0.1pF(B)  | GRM1535C1HR40BDD5D |
| 0.5pF(R50)        | ±0.1pF(B)  | GRM1535C1HR50BDD5D |
| 0.6pF(R60)        | ±0.1pF(B)  | GRM1535C1HR60BDD5D |
| 0.7pF(R70)        | ±0.1pF(B)  | GRM1535C1HR70BDD5D |
| 0.8pF(R80)        | ±0.1pF(B)  | GRM1535C1HR80BDD5D |
| 0.9pF(R90)        | ±0.1pF(B)  | GRM1535C1HR90BDD5D |
| 1.0pF(1R0)        | ±0.25pF(C) | GRM1535C1H1R0CDD5D |
| 1.1pF(1R1)        | ±0.25pF(C) | GRM1535C1H1R1CDD5D |
| 1.2pF(1R2)        | ±0.25pF(C) | GRM1535C1H1R2CDD5D |
| 1.3pF(1R3)        | ±0.25pF(C) | GRM1535C1H1R3CDD5D |
| 1.4pF(1R4)        | ±0.25pF(C) | GRM1535C1H1R4CDD5D |
| 1.5pF(1R5)        | ±0.25pF(C) | GRM1535C1H1R5CDD5D |
| 1.6pF(1R6)        | ±0.25pF(C) | GRM1535C1H1R6CDD5D |
| 1.7pF(1R7)        | ±0.25pF(C) | GRM1535C1H1R7CDD5D |
| 1.8pF(1R8)        | ±0.25pF(C) | GRM1535C1H1R8CDD5D |
| 1.9pF(1R9)        | ±0.25pF(C) | GRM1535C1H1R9CDD5D |
| 2.0pF(2R0)        | ±0.25pF(C) | GRM1535C1H2R0CDD5D |
| 2.1pF(2R1)        | ±0.25pF(C) | GRM1535C1H2R1CDD5D |
| 2.2pF(2R2)        | ±0.25pF(C) | GRM1535C1H2R2CDD5D |
| 2.3pF(2R3)        | ±0.25pF(C) | GRM1535C1H2R3CDD5D |
| 2.4pF(2R4)        | ±0.25pF(C) | GRM1535C1H2R4CDD5D |
| 2.5pF(2R5)        | ±0.25pF(C) | GRM1535C1H2R5CDD5D |
| 2.6pF(2R6)        | ±0.25pF(C) | GRM1535C1H2R6CDD5D |
| 2.7pF(2R7)        | ±0.25pF(C) | GRM1535C1H2R7CDD5D |
| 2.8pF(2R8)        | ±0.25pF(C) | GRM1535C1H2R8CDD5D |
| 2.9pF(2R9)        | ±0.25pF(C) | GRM1535C1H2R9CDD5D |
| 3.0pF(3R0)        | ±0.25pF(C) | GRM1535C1H3R0CDD5D |
| 3.1pF(3R1)        | ±0.25pF(C) | GRM1535C1H3R1CDD5D |
| 3.2pF(3R2)        | ±0.25pF(C) | GRM1535C1H3R2CDD5D |
| 3.3pF(3R3)        | ±0.25pF(C) | GRM1535C1H3R3CDD5D |
| 3.4pF(3R4)        | ±0.25pF(C) | GRM1535C1H3R4CDD5D |
| 3.5pF(3R5)        | ±0.25pF(C) | GRM1535C1H3R5CDD5D |
| 3.6pF(3R6)        | ±0.25pF(C) | GRM1535C1H3R6CDD5D |
| 3.7pF(3R7)        | ±0.25pF(C) | GRM1535C1H3R7CDD5D |
| 3.8pF(3R8)        | ±0.25pF(C) | GRM1535C1H3R8CDD5D |
| 3.9pF(3R9)        | ±0.25pF(C) | GRM1535C1H3R9CDD5D |
| 4.0pF(4R0)        | ±0.25pF(C) | GRM1535C1H4R0CDD5D |
| 4.1pF(4R1)        | ±0.25pF(C) | GRM1535C1H4R1CDD5D |
| 4.2pF(4R2)        | ±0.25pF(C) | GRM1535C1H4R2CDD5D |
| 4.3pF(4R3)        | ±0.25pF(C) | GRM1535C1H4R3CDD5D |
| 4.4pF(4R4)        | ±0.25pF(C) | GRM1535C1H4R4CDD5D |
| 4.5pF(4R5)        | ±0.25pF(C) | GRM1535C1H4R5CDD5D |
| 4.6pF(4R6)        | ±0.25pF(C) | GRM1535C1H4R6CDD5D |
| 4.7pF(4R7)        | ±0.25pF(C) | GRM1535C1H4R7CDD5D |
| 4.8pF(4R8)        | ±0.25pF(C) | GRM1535C1H4R8CDD5D |
| 4.9pF(4R9)        | ±0.25pF(C) | GRM1535C1H4R9CDD5D |
| 5.0pF(5R0)        | ±0.25pF(C) | GRM1535C1H5R0CDD5D |

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |
| 5.1pF(5R1)        | ±0.5pF(D) | GRM1535C1H5R1DDD5D |
| 5.2pF(5R2)        | ±0.5pF(D) | GRM1535C1H5R2DDD5D |
| 5.3pF(5R3)        | ±0.5pF(D) | GRM1535C1H5R3DDD5D |
| 5.4pF(5R4)        | ±0.5pF(D) | GRM1535C1H5R4DDD5D |
| 5.5pF(5R5)        | ±0.5pF(D) | GRM1535C1H5R5DDD5D |
| 5.6pF(5R6)        | ±0.5pF(D) | GRM1535C1H5R6DDD5D |
| 5.7pF(5R7)        | ±0.5pF(D) | GRM1535C1H5R7DDD5D |
| 5.8pF(5R8)        | ±0.5pF(D) | GRM1535C1H5R8DDD5D |
| 5.9pF(5R9)        | ±0.5pF(D) | GRM1535C1H5R9DDD5D |
| 6.0pF(6R0)        | ±0.5pF(D) | GRM1535C1H6R0DDD5D |
| 6.1pF(6R1)        | ±0.5pF(D) | GRM1535C1H6R1DDD5D |
| 6.2pF(6R2)        | ±0.5pF(D) | GRM1535C1H6R2DDD5D |
| 6.3pF(6R3)        | ±0.5pF(D) | GRM1535C1H6R3DDD5D |
| 6.4pF(6R4)        | ±0.5pF(D) | GRM1535C1H6R4DDD5D |
| 6.5pF(6R5)        | ±0.5pF(D) | GRM1535C1H6R5DDD5D |
| 6.6pF(6R6)        | ±0.5pF(D) | GRM1535C1H6R6DDD5D |
| 6.7pF(6R7)        | ±0.5pF(D) | GRM1535C1H6R7DDD5D |
| 6.8pF(6R8)        | ±0.5pF(D) | GRM1535C1H6R8DDD5D |
| 6.9pF(6R9)        | ±0.5pF(D) | GRM1535C1H6R9DDD5D |
| 7.0pF(7R0)        | ±0.5pF(D) | GRM1535C1H7R0DDD5D |
| 7.1pF(7R1)        | ±0.5pF(D) | GRM1535C1H7R1DDD5D |
| 7.2pF(7R2)        | ±0.5pF(D) | GRM1535C1H7R2DDD5D |
| 7.3pF(7R3)        | ±0.5pF(D) | GRM1535C1H7R3DDD5D |
| 7.4pF(7R4)        | ±0.5pF(D) | GRM1535C1H7R4DDD5D |
| 7.5pF(7R5)        | ±0.5pF(D) | GRM1535C1H7R5DDD5D |
| 7.6pF(7R6)        | ±0.5pF(D) | GRM1535C1H7R6DDD5D |
| 7.7pF(7R7)        | ±0.5pF(D) | GRM1535C1H7R7DDD5D |
| 7.8pF(7R8)        | ±0.5pF(D) | GRM1535C1H7R8DDD5D |
| 7.9pF(7R9)        | ±0.5pF(D) | GRM1535C1H7R9DDD5D |
| 8.0pF(8R0)        | ±0.5pF(D) | GRM1535C1H8R0DDD5D |
| 8.1pF(8R1)        | ±0.5pF(D) | GRM1535C1H8R1DDD5D |
| 8.2pF(8R2)        | ±0.5pF(D) | GRM1535C1H8R2DDD5D |
| 8.3pF(8R3)        | ±0.5pF(D) | GRM1535C1H8R3DDD5D |
| 8.4pF(8R4)        | ±0.5pF(D) | GRM1535C1H8R4DDD5D |
| 8.5pF(8R5)        | ±0.5pF(D) | GRM1535C1H8R5DDD5D |
| 8.6pF(8R6)        | ±0.5pF(D) | GRM1535C1H8R6DDD5D |
| 8.7pF(8R7)        | ±0.5pF(D) | GRM1535C1H8R7DDD5D |
| 8.8pF(8R8)        | ±0.5pF(D) | GRM1535C1H8R8DDD5D |
| 8.9pF(8R9)        | ±0.5pF(D) | GRM1535C1H8R9DDD5D |
| 9.0pF(9R0)        | ±0.5pF(D) | GRM1535C1H9R0DDD5D |
| 9.1pF(9R1)        | ±0.5pF(D) | GRM1535C1H9R1DDD5D |
| 9.2pF(9R2)        | ±0.5pF(D) | GRM1535C1H9R2DDD5D |
| 9.3pF(9R3)        | ±0.5pF(D) | GRM1535C1H9R3DDD5D |
| 9.4pF(9R4)        | ±0.5pF(D) | GRM1535C1H9R4DDD5D |
| 9.5pF(9R5)        | ±0.5pF(D) | GRM1535C1H9R5DDD5D |
| 9.6pF(9R6)        | ±0.5pF(D) | GRM1535C1H9R6DDD5D |
| 9.7pF(9R7)        | ±0.5pF(D) | GRM1535C1H9R7DDD5D |
| 9.8pF(9R8)        | ±0.5pF(D) | GRM1535C1H9R8DDD5D |
| 9.9pF(9R9)        | ±0.5pF(D) | GRM1535C1H9R9DDD5D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

# Temperature Compensating Type C0G(5C) Characteristics Low Profile

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |
| 10pF(100)         | ±5%(J)    | GRM1535C1H100JDD5D |
| 12pF(120)         | ±5%(J)    | GRM1535C1H120JDD5D |
| 15pF(150)         | ±5%(J)    | GRM1535C1H150JDD5D |
| 18pF(180)         | ±5%(J)    | GRM1535C1H180JDD5D |
| 22pF(220)         | ±5%(J)    | GRM1535C1H220JDD5D |
| 27pF(270)         | ±5%(J)    | GRM1535C1H270JDD5D |
| 33pF(330)         | ±5%(J)    | GRM1535C1H330JDD5D |
| 39pF(390)         | ±5%(J)    | GRM1535C1H390JDD5D |
| 47pF(470)         | ±5%(J)    | GRM1535C1H470JDD5D |
| 56pF(560)         | ±5%(J)    | GRM1535C1H560JDD5D |
| 68pF(680)         | ±5%(J)    | GRM1535C1H680JDD5D |
| 82pF(820)         | ±5%(J)    | GRM1535C1H820JDD5D |
| 100pF(101)        | ±5%(J)    | GRM1535C1H101JDD5D |
| 120pF(121)        | ±5%(J)    | GRM1535C1H121JDD5D |
| 150pF(151)        | ±5%(J)    | GRM1535C1H151JDD5D |
| 180pF(181)        | ±5%(J)    | GRM1535C1H181JDD5D |
| 220pF(221)        | ±5%(J)    | GRM1535C1H221JDD5D |
| 270pF(271)        | ±5%(J)    | GRM1535C1H271JDD5D |
| 330pF(331)        | ±5%(J)    | GRM1535C1H331JDD5D |
| 390pF(391)        | ±5%(J)    | GRM1535C1H391JDD5D |
| 470pF(471)        | ±5%(J)    | GRM1535C1H471JDD5D |
| 560pF(561)        | ±5%(J)    | GRM1535C1H561JDD5D |
| 680pF(681)        | ±5%(J)    | GRM1535C1H681JDD5D |

The part number code is shown in ( ) and Unit is shown in [.    < >: EIA [inch] Code

(Part Number)
 

|    |   |    |   |    |    |     |   |     |   |
|----|---|----|---|----|----|-----|---|-----|---|
| GR | M | 15 | 3 | 5C | 1H | 100 | J | DD5 | D |
| ①  | ② | ③  | ④ | ⑤  | ⑥  | ⑦   | ⑧ | ⑨   | ⑩ |

①Product ID      ②Series  
 ⑤Temperature Characteristics  
 ⑧Capacitance Tolerance

③Dimension (LxW)  
 ⑥Rated Voltage  
 ⑨Individual Specification Code

④Dimension (T)  
 ⑦Capacitance  
 ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.



## Temperature Compensating Type C0G(5C) Characteristics Low Profile

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    | 3.2x1.6(31)<1206>  |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 100pF(101)        | ±5%(J)    | GRM2165C2A101JA01D |                    |                    |                    |
| 120pF(121)        | ±5%(J)    | GRM2165C2A121JA01D |                    |                    |                    |
| 150pF(151)        | ±5%(J)    | GRM2165C2A151JA01D |                    |                    |                    |
| 180pF(181)        | ±5%(J)    | GRM2165C2A181JA01D |                    |                    |                    |
| 220pF(221)        | ±5%(J)    | GRM2165C2A221JA01D |                    |                    |                    |
| 270pF(271)        | ±5%(J)    | GRM2165C2A271JA01D |                    |                    |                    |
| 330pF(331)        | ±5%(J)    | GRM2165C2A331JA01D |                    |                    |                    |
| 390pF(391)        | ±5%(J)    | GRM2165C2A391JA01D |                    |                    |                    |
| 470pF(471)        | ±5%(J)    | GRM2165C2A471JA01D |                    |                    |                    |
| 560pF(561)        | ±5%(J)    | GRM2165C2A561JA01D |                    |                    |                    |
| 680pF(681)        | ±5%(J)    | GRM2165C2A681JA01D |                    |                    |                    |
| 820pF(821)        | ±5%(J)    | GRM2165C2A821JA01D |                    |                    |                    |
| 1000pF(102)       | ±5%(J)    | GRM2165C2A102JA01D |                    |                    |                    |
| 1200pF(122)       | ±5%(J)    | GRM2165C2A122JA01D | GRM2165C1H122JA01D |                    |                    |
| 1500pF(152)       | ±5%(J)    | GRM2165C2A152JA01D | GRM2165C1H152JA01D |                    |                    |
| 1800pF(182)       | ±5%(J)    | GRM2165C2A182JA01D | GRM2165C1H182JA01D | GRM3195C2A182JA01D |                    |
| 2200pF(222)       | ±5%(J)    | GRM2165C2A222JA01D | GRM2165C1H222JA01D | GRM3195C2A222JA01D |                    |
| 2700pF(272)       | ±5%(J)    | GRM2165C2A272JA01D | GRM2165C1H272JA01D | GRM3195C2A272JA01D |                    |
| 3300pF(332)       | ±5%(J)    | GRM2165C2A332JA01D | GRM2165C1H332JA01D | GRM3195C2A332JA01D |                    |
| 3900pF(392)       | ±5%(J)    |                    | GRM2165C1H392JA01D | GRM3195C2A392JA01D |                    |
| 4700pF(472)       | ±5%(J)    |                    | GRM2165C1H472JA01D | GRM3195C2A472JA01D | GRM3195C1H472JA01D |
| 5600pF(562)       | ±5%(J)    |                    | GRM2195C1H562JA01D | GRM3195C2A562JA01D | GRM3195C1H562JA01D |
| 6800pF(682)       | ±5%(J)    |                    | GRM2195C1H682JA01D | GRM3195C2A682JA01D | GRM3195C1H682JA01D |
| 8200pF(822)       | ±5%(J)    |                    | GRM2195C1H822JA01D | GRM3195C2A822JA01D | GRM3195C1H822JA01D |
| 10000pF(103)      | ±5%(J)    |                    | GRM2195C1H103JA01D | GRM3195C2A103JA01D | GRM3195C1H103JA01D |
| 12000pF(123)      | ±5%(J)    |                    | GRM2195C1H123JA01D |                    | GRM3195C1H123JA01D |
| 15000pF(153)      | ±5%(J)    |                    | GRM2195C1H153JA01D |                    | GRM3195C1H153JA01D |
| 18000pF(183)      | ±5%(J)    |                    |                    |                    | GRM3195C1H183JA01D |
| 22000pF(223)      | ±5%(J)    |                    |                    |                    | GRM3195C1H223JA01D |
| 27000pF(273)      | ±5%(J)    |                    |                    |                    | GRM3195C1H273JA01D |
| 33000pF(333)      | ±5%(J)    |                    |                    |                    | GRM3195C1H333JA01D |
| 39000pF(393)      | ±5%(J)    |                    |                    |                    | GRM3195C1H393JA01D |
| 47000pF(473)      | ±5%(J)    |                    |                    |                    | GRM31M5C1H473JA01L |
| 56000pF(563)      | ±5%(J)    |                    |                    |                    | GRM31M5C1H563JA01L |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type U2J(7U) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  |                    | 1.0x0.5(15)<0402>  |                    |
|-------------------|------------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 50(1H)             | 25(1E)             | 50(1H)             | 10(1A)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |                    |
| 1.0pF(1R0)        | ±0.25pF(C) | GRM0337U1H1R0CD01D |                    | GRM1557U1H1R0CZ01D |                    |
| 2.0pF(2R0)        | ±0.25pF(C) | GRM0337U1H2R0CD01D |                    | GRM1557U1H2R0CZ01D |                    |
| 3.0pF(3R0)        | ±0.25pF(C) | GRM0337U1H3R0CD01D |                    | GRM1557U1H3R0CZ01D |                    |
| 4.0pF(4R0)        | ±0.25pF(C) | GRM0337U1H4R0CD01D |                    | GRM1557U1H4R0CZ01D |                    |
| 5.0pF(5R0)        | ±0.25pF(C) | GRM0337U1H5R0CD01D |                    | GRM1557U1H5R0CZ01D |                    |
| 6.0pF(6R0)        | ±0.5pF(D)  | GRM0337U1H6R0DD01D |                    | GRM1557U1H6R0DZ01D |                    |
| 7.0pF(7R0)        | ±0.5pF(D)  | GRM0337U1H7R0DD01D |                    | GRM1557U1H7R0DZ01D |                    |
| 8.0pF(8R0)        | ±0.5pF(D)  | GRM0337U1H8R0DD01D |                    | GRM1557U1H8R0DZ01D |                    |
| 9.0pF(9R0)        | ±0.5pF(D)  | GRM0337U1H9R0DD01D |                    | GRM1557U1H9R0DZ01D |                    |
| 10pF(100)         | ±5%(J)     | GRM0337U1H100JD01D |                    | GRM1557U1H100JZ01D |                    |
| 12pF(120)         | ±5%(J)     | GRM0337U1H120JD01D |                    | GRM1557U1H120JZ01D |                    |
| 15pF(150)         | ±5%(J)     | GRM0337U1H150JD01D |                    | GRM1557U1H150JZ01D |                    |
| 18pF(180)         | ±5%(J)     |                    | GRM0337U1E180JD01D | GRM1557U1H180JZ01D |                    |
| 22pF(220)         | ±5%(J)     |                    | GRM0337U1E220JD01D | GRM1557U1H220JZ01D |                    |
| 27pF(270)         | ±5%(J)     |                    | GRM0337U1E270JD01D | GRM1557U1H270JZ01D |                    |
| 33pF(330)         | ±5%(J)     |                    | GRM0337U1E330JD01D | GRM1557U1H330JZ01D |                    |
| 39pF(390)         | ±5%(J)     |                    | GRM0337U1E390JD01D | GRM1557U1H390JZ01D |                    |
| 47pF(470)         | ±5%(J)     |                    | GRM0337U1E470JD01D | GRM1557U1H470JZ01D |                    |
| 56pF(560)         | ±5%(J)     |                    | GRM0337U1E560JD01D | GRM1557U1H560JZ01D |                    |
| 68pF(680)         | ±5%(J)     |                    | GRM0337U1E680JD01D | GRM1557U1H680JZ01D |                    |
| 82pF(820)         | ±5%(J)     |                    | GRM0337U1E820JD01D | GRM1557U1H820JZ01D |                    |
| 100pF(101)        | ±5%(J)     |                    | GRM0337U1E101JD01D | GRM1557U1H101JZ01D |                    |
| 120pF(121)        | ±5%(J)     |                    |                    | GRM1557U1H121JZ01D |                    |
| 150pF(151)        | ±5%(J)     |                    |                    | GRM1557U1H151JZ01D |                    |
| 180pF(181)        | ±5%(J)     |                    |                    | GRM1557U1H181JZ01D |                    |
| 1200pF(122)       | ±5%(J)     |                    |                    |                    | GRM1557U1A122JA01D |
| 1500pF(152)       | ±5%(J)     |                    |                    |                    | GRM1557U1A152JA01D |
| 1800pF(182)       | ±5%(J)     |                    |                    |                    | GRM1557U1A182JA01D |
| 2200pF(222)       | ±5%(J)     |                    |                    |                    | GRM1557U1A222JA01D |
| 2700pF(272)       | ±5%(J)     |                    |                    |                    | GRM1557U1A272JA01D |
| 3300pF(332)       | ±5%(J)     |                    |                    |                    | GRM1557U1A332JA01D |
| 3900pF(392)       | ±5%(J)     |                    |                    |                    | GRM1557U1A392JA01D |
| 4700pF(472)       | ±5%(J)     |                    |                    |                    | GRM1557U1A472JA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

(Part Number) **GR** **M** **03** **3** **7U** **1H** **1R0** **C** **D01** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type U2J(7U) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603>  |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |
| 1000pF(102)       | ±5%(J)    | GRM1887U1H102JA01D |                    |
| 1200pF(122)       | ±5%(J)    | GRM1887U1H122JA01D |                    |
| 1500pF(152)       | ±5%(J)    | GRM1887U1H152JA01D |                    |
| 1800pF(182)       | ±5%(J)    | GRM1887U1H182JA01D |                    |
| 2200pF(222)       | ±5%(J)    | GRM1887U1H222JA01D |                    |
| 2700pF(272)       | ±5%(J)    | GRM1887U1H272JA01D |                    |
| 3300pF(332)       | ±5%(J)    | GRM1887U1H332JA01D |                    |
| 3900pF(392)       | ±5%(J)    | GRM1887U1H392JA01D |                    |
| 4700pF(472)       | ±5%(J)    | GRM1887U1H472JA01D |                    |
| 5600pF(562)       | ±5%(J)    | GRM1887U1H562JA01D |                    |
| 6800pF(682)       | ±5%(J)    | GRM1887U1H682JA01D |                    |
| 8200pF(822)       | ±5%(J)    | GRM1887U1H822JA01D |                    |
| 10000pF(103)      | ±5%(J)    | GRM1887U1H103JA01D |                    |
| 12000pF(123)      | ±5%(J)    |                    | GRM1887U1A123JA01D |
| 15000pF(153)      | ±5%(J)    |                    | GRM1887U1A153JA01D |
| 18000pF(183)      | ±5%(J)    |                    | GRM1887U1A183JA01D |
| 22000pF(223)      | ±5%(J)    |                    | GRM1887U1A223JA01D |

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    | 3.2x1.6(31)<1206>  |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 10(1A)             | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 10000pF(103)      | ±5%(J)    | GRM2167U1H103JA01D |                    |                    |
| 12000pF(123)      | ±5%(J)    | GRM2167U1H123JA01D |                    |                    |
| 15000pF(153)      | ±5%(J)    | GRM2167U1H153JA01D |                    |                    |
| 18000pF(183)      | ±5%(J)    | GRM2167U1H183JA01D |                    |                    |
| 22000pF(223)      | ±5%(J)    | GRM2197U1H223JA01D |                    |                    |
| 27000pF(273)      | ±5%(J)    | GRM2197U1H273JA01D |                    |                    |
| 33000pF(333)      | ±5%(J)    | GRM21A7U1H333JA39L |                    |                    |
| 39000pF(393)      | ±5%(J)    | GRM21B7U1H393JA01L |                    |                    |
| 47000pF(473)      | ±5%(J)    | GRM21B7U1H473JA01L |                    |                    |
| 56000pF(563)      | ±5%(J)    |                    | GRM2197U1A563JA01D | GRM3197U1H563JA01D |
| 68000pF(683)      | ±5%(J)    |                    | GRM21B7U1A683JA01L | GRM31M7U1H683JA01L |
| 82000pF(823)      | ±5%(J)    |                    | GRM21B7U1A823JA01L | GRM31M7U1H823JA01L |
| 100000pF(104)     | ±5%(J)    |                    | GRM21B7U1A104JA01L | GRM31M7U1H104JA01L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type U2J(7U) Characteristics Low Profile

| LxW [mm]          |           | 1.6x0.8(18)<0603>  |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |
| 2200pF(222)       | ±5%(J)    | GRM1857U1H222JA44D |                    |
| 2700pF(272)       | ±5%(J)    | GRM1857U1H272JA44D |                    |
| 3300pF(332)       | ±5%(J)    | GRM1857U1H332JA44D |                    |
| 3900pF(392)       | ±5%(J)    | GRM1857U1H392JA44D |                    |
| 4700pF(472)       | ±5%(J)    | GRM1857U1H472JA44D |                    |
| 5600pF(562)       | ±5%(J)    |                    | GRM1857U1A562JA44D |
| 6800pF(682)       | ±5%(J)    |                    | GRM1857U1A682JA44D |
| 8200pF(822)       | ±5%(J)    |                    | GRM1857U1A822JA44D |
| 10000pF(103)      | ±5%(J)    |                    | GRM1857U1A103JA44D |

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    | 3.2x1.6(31)<1206>  |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 10(1A)             | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 10000pF(103)      | ±5%(J)    | GRM2167U1H103JA01D |                    |                    |
| 12000pF(123)      | ±5%(J)    | GRM2167U1H123JA01D |                    |                    |
| 15000pF(153)      | ±5%(J)    | GRM2167U1H153JA01D |                    |                    |
| 18000pF(183)      | ±5%(J)    | GRM2167U1H183JA01D |                    |                    |
| 22000pF(223)      | ±5%(J)    | GRM2197U1H223JA01D |                    |                    |
| 27000pF(273)      | ±5%(J)    | GRM2197U1H273JA01D |                    |                    |
| 33000pF(333)      | ±5%(J)    | GRM21A7U1H333JA39L |                    |                    |
| 56000pF(563)      | ±5%(J)    |                    | GRM2197U1A563JA01D | GRM3197U1H563JA01D |
| 68000pF(683)      | ±5%(J)    |                    |                    | GRM31M7U1H683JA01L |
| 82000pF(823)      | ±5%(J)    |                    |                    | GRM31M7U1H823JA01L |
| 100000pF(104)     | ±5%(J)    |                    |                    | GRM31M7U1H104JA01L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **18** **5** **7U** **1H** **222** **J** **A44** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

①Product ID ②Series  
 ⑤Temperature Characteristics  
 ⑧Capacitance Tolerance

③Dimension (LxW)  
 ⑥Rated Voltage  
 ⑨Individual Specification Code

④Dimension (T)  
 ⑦Capacitance  
 ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type P2H(6P) Characteristics

| LxW [mm]          |            | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|
| Rated Volt. [Vdc] |            | 50(1H)             |
| Capacitance       | Tolerance  |                    |
| 1.0pF(1R0)        | ±0.25pF(C) | GRM1556P1H1R0CZ01D |
| 2.0pF(2R0)        | ±0.25pF(C) | GRM1556P1H2R0CZ01D |
| 3.0pF(3R0)        | ±0.25pF(C) | GRM1556P1H3R0CZ01D |
| 4.0pF(4R0)        | ±0.25pF(C) | GRM1556P1H4R0CZ01D |
| 5.0pF(5R0)        | ±0.25pF(C) | GRM1556P1H5R0CZ01D |
| 6.0pF(6R0)        | ±0.5pF(D)  | GRM1556P1H6R0DZ01D |
| 7.0pF(7R0)        | ±0.5pF(D)  | GRM1556P1H7R0DZ01D |
| 8.0pF(8R0)        | ±0.5pF(D)  | GRM1556P1H8R0DZ01D |
| 9.0pF(9R0)        | ±0.5pF(D)  | GRM1556P1H9R0DZ01D |
| 10pF(100)         | ±5%(J)     | GRM1556P1H100JZ01D |
| 12pF(120)         | ±5%(J)     | GRM1556P1H120JZ01D |
| 15pF(150)         | ±5%(J)     | GRM1556P1H150JZ01D |
| 18pF(180)         | ±5%(J)     | GRM1556P1H180JZ01D |
| 22pF(220)         | ±5%(J)     | GRM1556P1H220JZ01D |
| 27pF(270)         | ±5%(J)     | GRM1556P1H270JZ01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type R2H(6R) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 1.0pF(1R0)        | ±0.25pF(C) | GRM0336R1E1R0CD01D | GRM1556R1H1R0CD01D |
| 2.0pF(2R0)        | ±0.25pF(C) | GRM0336R1E2R0CD01D | GRM1556R1H2R0CZ01D |
| 3.0pF(3R0)        | ±0.25pF(C) | GRM0336R1E3R0CD01D | GRM1556R1H3R0CZ01D |
| 4.0pF(4R0)        | ±0.25pF(C) | GRM0336R1E4R0CD01D | GRM1556R1H4R0CZ01D |
| 5.0pF(5R0)        | ±0.25pF(C) | GRM0336R1E5R0CD01D | GRM1556R1H5R0CZ01D |
| 6.0pF(6R0)        | ±0.5pF(D)  | GRM0336R1E6R0DD01D | GRM1556R1H6R0DZ01D |
| 7.0pF(7R0)        | ±0.5pF(D)  | GRM0336R1E7R0DD01D | GRM1556R1H7R0DZ01D |
| 8.0pF(8R0)        | ±0.5pF(D)  | GRM0336R1E8R0DD01D | GRM1556R1H8R0DZ01D |
| 9.0pF(9R0)        | ±0.5pF(D)  | GRM0336R1E9R0DD01D | GRM1556R1H9R0DZ01D |
| 10pF(100)         | ±5%(J)     | GRM0336R1E100JD01D | GRM1556R1H100JZ01D |
| 12pF(120)         | ±5%(J)     | GRM0336R1E120JD01D | GRM1556R1H120JZ01D |
| 15pF(150)         | ±5%(J)     | GRM0336R1E150JD01D | GRM1556R1H150JZ01D |
| 18pF(180)         | ±5%(J)     | GRM0336R1E180JD01D | GRM1556R1H180JZ01D |
| 22pF(220)         | ±5%(J)     | GRM0336R1E220JD01D | GRM1556R1H220JZ01D |
| 27pF(270)         | ±5%(J)     | GRM0336R1E270JD01D | GRM1556R1H270JZ01D |
| 33pF(330)         | ±5%(J)     | GRM0336R1E330JD01D | GRM1556R1H330JZ01D |
| 39pF(390)         | ±5%(J)     | GRM0336R1E390JD01D |                    |
| 47pF(470)         | ±5%(J)     | GRM0336R1E470JD01D |                    |
| 56pF(560)         | ±5%(J)     | GRM0336R1E560JD01D |                    |
| 68pF(680)         | ±5%(J)     | GRM0336R1E680JD01D |                    |
| 82pF(820)         | ±5%(J)     | GRM0336R1E820JD01D |                    |
| 100pF(101)        | ±5%(J)     | GRM0336R1E101JD01D |                    |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type S2H(6S) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 1.0pF(1R0)        | ±0.25pF(C) | GRM0336S1E1R0CD01D | GRM1556S1H1R0CD01D |
| 2.0pF(2R0)        | ±0.25pF(C) | GRM0336S1E2R0CD01D | GRM1556S1H2R0CZ01D |
| 3.0pF(3R0)        | ±0.25pF(C) | GRM0336S1E3R0CD01D | GRM1556S1H3R0CZ01D |
| 4.0pF(4R0)        | ±0.25pF(C) | GRM0336S1E4R0CD01D | GRM1556S1H4R0CZ01D |
| 5.0pF(5R0)        | ±0.25pF(C) | GRM0336S1E5R0CD01D | GRM1556S1H5R0CZ01D |
| 6.0pF(6R0)        | ±0.5pF(D)  | GRM0336S1E6R0DD01D | GRM1556S1H6R0DZ01D |
| 7.0pF(7R0)        | ±0.5pF(D)  | GRM0336S1E7R0DD01D | GRM1556S1H7R0DZ01D |
| 8.0pF(8R0)        | ±0.5pF(D)  | GRM0336S1E8R0DD01D | GRM1556S1H8R0DZ01D |
| 9.0pF(9R0)        | ±0.5pF(D)  | GRM0336S1E9R0DD01D | GRM1556S1H9R0DZ01D |
| 10pF(100)         | ±5%(J)     | GRM0336S1E100JD01D | GRM1556S1H100JZ01D |
| 12pF(120)         | ±5%(J)     | GRM0336S1E120JD01D | GRM1556S1H120JZ01D |
| 15pF(150)         | ±5%(J)     | GRM0336S1E150JD01D | GRM1556S1H150JZ01D |
| 18pF(180)         | ±5%(J)     | GRM0336S1E180JD01D | GRM1556S1H180JZ01D |
| 22pF(220)         | ±5%(J)     | GRM0336S1E220JD01D | GRM1556S1H220JZ01D |
| 27pF(270)         | ±5%(J)     | GRM0336S1E270JD01D | GRM1556S1H270JZ01D |
| 33pF(330)         | ±5%(J)     | GRM0336S1E330JD01D | GRM1556S1H330JZ01D |
| 39pF(390)         | ±5%(J)     | GRM0336S1E390JD01D | GRM1556S1H390JZ01D |
| 47pF(470)         | ±5%(J)     | GRM0336S1E470JD01D |                    |
| 56pF(560)         | ±5%(J)     | GRM0336S1E560JD01D |                    |
| 68pF(680)         | ±5%(J)     | GRM0336S1E680JD01D |                    |
| 82pF(820)         | ±5%(J)     | GRM0336S1E820JD01D |                    |
| 100pF(101)        | ±5%(J)     | GRM0336S1E101JD01D |                    |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GR** **M** **03** **3** **6S** **1E** **1R0** **C** **D01** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type T2H(6T) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 1.0pF(1R0)        | ±0.25pF(C) | GRM0336T1E1R0CD01D | GRM1556T1H1R0CD01D |
| 2.0pF(2R0)        | ±0.25pF(C) | GRM0336T1E2R0CD01D | GRM1556T1H2R0CD01D |
| 3.0pF(3R0)        | ±0.25pF(C) | GRM0336T1E3R0CD01D | GRM1556T1H3R0CD01D |
| 4.0pF(4R0)        | ±0.25pF(C) | GRM0336T1E4R0CD01D | GRM1556T1H4R0CD01D |
| 5.0pF(5R0)        | ±0.25pF(C) | GRM0336T1E5R0CD01D | GRM1556T1H5R0CD01D |
| 6.0pF(6R0)        | ±0.5pF(D)  | GRM0336T1E6R0DD01D | GRM1556T1H6R0DD01D |
| 7.0pF(7R0)        | ±0.5pF(D)  | GRM0336T1E7R0DD01D | GRM1556T1H7R0DD01D |
| 8.0pF(8R0)        | ±0.5pF(D)  | GRM0336T1E8R0DD01D | GRM1556T1H8R0DD01D |
| 9.0pF(9R0)        | ±0.5pF(D)  | GRM0336T1E9R0DD01D | GRM1556T1H9R0DD01D |
| 10pF(100)         | ±5%(J)     | GRM0336T1E100JD01D | GRM1556T1H100JD01D |
| 12pF(120)         | ±5%(J)     | GRM0336T1E120JD01D | GRM1556T1H120JD01D |
| 15pF(150)         | ±5%(J)     | GRM0336T1E150JD01D | GRM1556T1H150JD01D |
| 18pF(180)         | ±5%(J)     | GRM0336T1E180JD01D | GRM1556T1H180JD01D |
| 22pF(220)         | ±5%(J)     | GRM0336T1E220JD01D | GRM1556T1H220JD01D |
| 27pF(270)         | ±5%(J)     | GRM0336T1E270JD01D | GRM1556T1H270JD01D |
| 33pF(330)         | ±5%(J)     | GRM0336T1E330JD01D | GRM1556T1H330JD01D |
| 39pF(390)         | ±5%(J)     | GRM0336T1E390JD01D | GRM1556T1H390JD01D |
| 47pF(470)         | ±5%(J)     | GRM0336T1E470JD01D | GRM1556T1H470JD01D |
| 56pF(560)         | ±5%(J)     | GRM0336T1E560JD01D | GRM1556T1H560JD01D |
| 68pF(680)         | ±5%(J)     | GRM0336T1E680JD01D | GRM1556T1H680JD01D |
| 82pF(820)         | ±5%(J)     | GRM0336T1E820JD01D | GRM1556T1H820JD01D |
| 100pF(101)        | ±5%(J)     | GRM0336T1E101JD01D | GRM1556T1H101JD01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## High Dielectric Constant Type X7R(R7) Characteristics

|                   |           |                    |
|-------------------|-----------|--------------------|
| LxW [mm]          |           | 0.4x0.2(02)<01005> |
| Rated Volt. [Vdc] |           | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |
| 68pF(680)         | ±10%(K)   | GRM022R71A680KA01L |
| 100pF(101)        | ±10%(K)   | GRM022R71A101KA01L |
| 150pF(151)        | ±10%(K)   | GRM022R71A151KA01L |
| 220pF(221)        | ±10%(K)   | GRM022R71A221KA01L |
| 330pF(331)        | ±10%(K)   | GRM022R71A331KA01L |
| 470pF(471)        | ±10%(K)   | GRM022R71A471KA01L |

|                   |           |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| LxW [mm]          |           | 0.6x0.3(03)<0201>  |                    |                    |
| Rated Volt. [Vdc] |           | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 100pF(101)        | ±10%(K)   | GRM033R71E101KA01D |                    |                    |
| 150pF(151)        | ±10%(K)   | GRM033R71E151KA01D |                    |                    |
| 220pF(221)        | ±10%(K)   | GRM033R71E221KA01D |                    |                    |
| 330pF(331)        | ±10%(K)   | GRM033R71E331KA01D |                    |                    |
| 470pF(471)        | ±10%(K)   | GRM033R71E471KA01D |                    |                    |
| 680pF(681)        | ±10%(K)   | GRM033R71E681KA01D |                    |                    |
| 1000pF(102)       | ±10%(K)   | GRM033R71E102KA01D |                    |                    |
| 1500pF(152)       | ±10%(K)   | GRM033R71E152KA01D |                    |                    |
| 2200pF(222)       | ±10%(K)   |                    | GRM033R71C222KA88D |                    |
| 3300pF(332)       | ±10%(K)   |                    | GRM033R71C332KA88D |                    |
| 4700pF(472)       | ±10%(K)   |                    |                    | GRM033R71A472KA01D |
| 6800pF(682)       | ±10%(K)   |                    |                    | GRM033R71A682KA01D |
| 10000pF(103)      | ±10%(K)   |                    |                    | GRM033R71A103KA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) GR M 02 2 R7 1A 680 K A01 L

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID      ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging\*

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

\*GRM022: D is applicable.

## High Dielectric Constant Type X7R(R7) Characteristics

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 25(1E)             | 16(1C)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 220pF(221)        | ±10%(K)   | GRM155R72A221KA01D | GRM155R71H221KA01D |                    |                    |
| 330pF(331)        | ±10%(K)   | GRM155R72A331KA01D | GRM155R71H331KA01D |                    |                    |
| 470pF(471)        | ±10%(K)   | GRM155R72A471KA01D | GRM155R71H471KA01D |                    |                    |
| 680pF(681)        | ±10%(K)   | GRM155R72A681KA01D | GRM155R71H681KA01D |                    |                    |
| 1000pF(102)       | ±10%(K)   | GRM155R72A102KA01D | GRM155R71H102KA01D |                    |                    |
| 1500pF(152)       | ±10%(K)   | GRM155R72A152KA01D | GRM155R71H152KA01D |                    |                    |
| 2200pF(222)       | ±10%(K)   | GRM155R72A222KA01D | GRM155R71H222KA01D |                    |                    |
| 3300pF(332)       | ±10%(K)   | GRM155R72A332KA01D | GRM155R71H332KA01D |                    |                    |
| 4700pF(472)       | ±10%(K)   | GRM155R72A472KA01D | GRM155R71H472KA01D | GRM155R71E472KA01D |                    |
| 6800pF(682)       | ±10%(K)   |                    | GRM155R71H682KA88D | GRM155R71E682KA01D |                    |
| 10000pF(103)      | ±10%(K)   |                    | GRM155R71H103KA88D | GRM155R71E103KA01D |                    |
| 15000pF(153)      | ±10%(K)   |                    | GRM155R71H153KA12D | GRM155R71E153KA61D | GRM155R71C153KA01D |
| 22000pF(223)      | ±10%(K)   |                    | GRM155R71H223KA12D | GRM155R71E223KA61D | GRM155R71C223KA01D |
| 33000pF(333)      | ±10%(K)   |                    |                    | GRM155R71E333KA88D | GRM155R71C333KA01D |
| 47000pF(473)      | ±10%(K)   |                    |                    | GRM155R71E473KA88D | GRM155R71C473KA01D |
| 68000pF(683)      | ±10%(K)   |                    |                    |                    | GRM155R71C683KA88D |
| 0.10μF(104)       | ±10%(K)   |                    |                    |                    | GRM155R71C104KA88D |

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |
| 68000pF(683)      | ±10%(K)   | GRM155R71A683KA01D |
| 0.10μF(104)       | ±10%(K)   | GRM155R71A104KA01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## High Dielectric Constant Type X7R(R7)/X7S(C7) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603>  |                    |                     |                     |
|-------------------|-----------|--------------------|--------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number        |                    |                     |                     |
| 220pF(221)        | ±10%(K)   | GRM188R72A221KA01D | GRM188R71H221KA01D |                     |                     |
| 330pF(331)        | ±10%(K)   | GRM188R72A331KA01D | GRM188R71H331KA01D |                     |                     |
| 470pF(471)        | ±10%(K)   | GRM188R72A471KA01D | GRM188R71H471KA01D |                     |                     |
| 680pF(681)        | ±10%(K)   | GRM188R72A681KA01D | GRM188R71H681KA01D |                     |                     |
| 1000pF(102)       | ±10%(K)   | GRM188R72A102KA01D | GRM188R71H102KA01D |                     |                     |
| 1500pF(152)       | ±10%(K)   | GRM188R72A152KA01D | GRM188R71H152KA01D |                     |                     |
| 2200pF(222)       | ±10%(K)   | GRM188R72A222KA01D | GRM188R71H222KA01D |                     |                     |
| 3300pF(332)       | ±10%(K)   | GRM188R72A332KA01D | GRM188R71H332KA01D |                     |                     |
| 4700pF(472)       | ±10%(K)   | GRM188R72A472KA01D | GRM188R71H472KA01D |                     |                     |
| 6800pF(682)       | ±10%(K)   | GRM188R72A682KA01D | GRM188R71H682KA01D |                     |                     |
| 10000pF(103)      | ±10%(K)   | GRM188R72A103KA01D | GRM188R71H103KA01D | GRM188R71E103KA01D  |                     |
| 15000pF(153)      | ±10%(K)   |                    | GRM188R71H153KA01D | GRM188R71E153KA01D  |                     |
| 22000pF(223)      | ±10%(K)   |                    | GRM188R71H223KA01D | GRM188R71E223KA01D  |                     |
| 33000pF(333)      | ±10%(K)   |                    | GRM188R71H333KA61D | GRM188R71E333KA01D  |                     |
| 47000pF(473)      | ±10%(K)   |                    | GRM188R71H473KA61D | GRM188R71E473KA01D  |                     |
| 68000pF(683)      | ±10%(K)   |                    | GRM188R71H683KA93D | GRM188R71E683KA01D  |                     |
| 0.10μF(104)       | ±10%(K)   | GRM188R72A104KA35D | GRM188R71H104KA93D | GRM188R71E104KA01D  |                     |
| 0.15μF(154)       | ±10%(K)   |                    |                    | GRM188R71E154KA01D  | GRM188R71C154KA01D  |
| 0.22μF(224)       | ±10%(K)   |                    |                    | GRM188R71E224KA88D  | GRM188R71C224KA01D  |
| 0.33μF(334)       | ±10%(K)   |                    |                    |                     | GRM188R71C334KA01D  |
| 0.47μF(474)       | ±10%(K)   |                    |                    | GRM188R71E474KA12D* | GRM188R71C474KA88D  |
| 1.0μF(105)        | ±10%(K)   |                    |                    | GRM188R71E105KA12D* | GRM188R71C105KA12D* |

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 0.33μF(334)       | ±10%(K)   | GRM188R71A334KA61D  |                     |                     |
| 0.47μF(474)       | ±10%(K)   | GRM188R71A474KA61D  |                     |                     |
| 0.68μF(684)       | ±10%(K)   | GRM188R71A684KA61D  |                     |                     |
| 1.0μF(105)        | ±10%(K)   | GRM188R71A105KA61D* |                     |                     |
| 2.2μF(225)        | ±10%(K)   | GRM188R71A225KE15D* | GRM188C70J225KE20D* | GRM188C70G225KE20D* |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

\*: Please refer to GRM Series Specifications and Test Method(2).

(Part Number) **GR** **M** **18** **8** **R7** **2A** **221** **K** **A01** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## High Dielectric Constant Type X7R(R7)/X7U(E7) Characteristics

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    |                     |                     |
|-------------------|-----------|--------------------|--------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number        |                    |                     |                     |
| 6800pF(682)       | ±10%(K)   | GRM219R72A682KA01D |                    |                     |                     |
| 10000pF(103)      | ±10%(K)   | GRM21BR72A103KA01L |                    |                     |                     |
| 15000pF(153)      | ±10%(K)   | GRM21BR72A153KA01L |                    |                     |                     |
| 22000pF(223)      | ±10%(K)   | GRM21BR72A223KA01L |                    |                     |                     |
| 33000pF(333)      | ±10%(K)   | GRM21BR72A333KA01L | GRM219R71H333KA01D |                     |                     |
| 47000pF(473)      | ±10%(K)   | GRM21BR72A473KA01L | GRM21BR71H473KA01L |                     |                     |
| 68000pF(683)      | ±10%(K)   |                    | GRM21BR71H683KA01L | GRM219R71E683KA01D  |                     |
| 0.10μF(104)       | ±10%(K)   |                    | GRM21BR71H104KA01L | GRM21BR71E104KA01L  |                     |
| 0.15μF(154)       | ±10%(K)   |                    | GRM21BR71H154KA01L | GRM21BR71E154KA01L  |                     |
| 0.22μF(224)       | ±10%(K)   | GRM21AR72A224KAC5L | GRM21BR71H224KA01L | GRM21BR71E224KA01L  |                     |
| 0.33μF(334)       | ±10%(K)   | GRM21AR72A334KAC5L | GRM219R71H334KA88D | GRM21BR71E334KA01L  |                     |
| 0.47μF(474)       | ±10%(K)   | GRM21BR72A474KA73L | GRM21BR71H474KA88L | GRM219R71E474KA88D  |                     |
| 0.68μF(684)       | ±10%(K)   |                    |                    | GRM219R71E684KA88D  | GRM219R71C684KA01D  |
| 1.0μF(105)        | ±10%(K)   |                    | GRM21BR71H105KA12L | GRM21BR71E105KA99L  | GRM21BR71C105KA01L  |
|                   |           |                    |                    | GRM219R71E105KA88D  |                     |
| 2.2μF(225)        | ±10%(K)   |                    |                    | GRM21BR71E225KA73L* | GRM21BR71C225KA12L  |
| 4.7μF(475)        | ±10%(K)   |                    |                    |                     | GRM21BR71C475KA73L* |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 2.2μF(225)        | ±10%(K)   | GRM21BR71A225KA01L  |                     |                     |
| 4.7μF(475)        | ±10%(K)   | GRM21BR71A475KA73L* |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM21BR71A106KE51L* | GRM21BR70J106KE76L* |                     |
| 22μF(226)         | ±20%(M)   |                     |                     | GRM21BE70G226ME51L* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GRM Series Specifications and Test Method(2).

High Dielectric Constant Type X7R(R7)/X7U(E7) Characteristics

| LxW [mm]          |           | 3.2x1.6(31)<1206>  |                    |                     |                     |
|-------------------|-----------|--------------------|--------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number        |                    |                     |                     |
| 15000pF(153)      | ±10%(K)   | GRM319R72A153KA01L |                    |                     |                     |
| 22000pF(223)      | ±10%(K)   | GRM31MR72A223KA01L |                    |                     |                     |
| 33000pF(333)      | ±10%(K)   | GRM31MR72A333KA01L |                    |                     |                     |
| 47000pF(473)      | ±10%(K)   | GRM31MR72A473KA01L |                    |                     |                     |
| 68000pF(683)      | ±10%(K)   | GRM31MR72A683KA01L |                    |                     |                     |
| 0.10μF(104)       | ±10%(K)   | GRM319R72A104KA01D |                    |                     |                     |
| 0.15μF(154)       | ±10%(K)   | GRM31MR72A154KA01L | GRM31MR71H154KA01L |                     |                     |
| 0.22μF(224)       | ±10%(K)   | GRM31MR72A224KA01L | GRM31MR71H224KA01L |                     |                     |
| 0.33μF(334)       | ±10%(K)   |                    | GRM319R71H334KA01D |                     |                     |
| 0.47μF(474)       | ±10%(K)   | GRM31MR72A474KA35L | GRM31MR71H474KA01L |                     |                     |
| 0.68μF(684)       | ±10%(K)   | GRM31MR72A684KA35L | GRM31MR71H684KA88L |                     |                     |
| 1.0μF(105)        | ±10%(K)   | GRM31CR72A105KA01L | GRM31MR71H105KA88L |                     |                     |
| 2.2μF(225)        | ±10%(K)   |                    | GRM31CR71H225KA88L | GRM31MR71E225KA93L  | GRM31MR71C225KA35L  |
| 4.7μF(475)        | ±10%(K)   |                    | GRM31CR71H475KA12L | GRM31CR71E475KA88L  | GRM31CR71C475KA01L  |
| 10μF(106)         | ±10%(K)   |                    |                    | GRM31CR71E106KA12L* | GRM31CR71C106KAC7L* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM31CR71A106KA01L  |                     |                     |
| 22μF(226)         | ±20%(M)   | GRM31CR71A226ME15L* | GRM31CR70J226ME19L* |                     |
| 47μF(476)         | ±20%(M)   |                     |                     | GRM31CE70G476ME15L* |

| LxW [mm]          |           | 3.2x2.5(32)<1210>  |                    |                    |                     |
|-------------------|-----------|--------------------|--------------------|--------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 35(YA)             | 25(1E)              |
| Capacitance       | Tolerance | Part Number        |                    |                    |                     |
| 0.68μF(684)       | ±10%(K)   | GRM32CR72A684KA01L | GRM32NR71H684KA01L |                    |                     |
| 1.0μF(105)        | ±10%(K)   | GRM32CR72A105KA35L |                    |                    |                     |
| 2.2μF(225)        | ±10%(K)   | GRM32ER72A225KA35L |                    |                    |                     |
| 4.7μF(475)        | ±10%(K)   |                    | GRM32ER71H475KA88L |                    |                     |
| 10μF(106)         | ±10%(K)   |                    |                    | GRM32ER7YA106KA12L | GRM32DR71E106KA12L  |
| 22μF(226)         | ±20%(M)   |                    |                    |                    | GRM32ER71E226ME15L* |

| LxW [mm]          |           | 3.2x2.5(32)<1210>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 16(1C)              | 10(1A)              | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 22μF(226)         | ±20%(M)   | GRM32ER71C226ME18L* |                     |                     |
| 47μF(476)         | ±20%(M)   |                     | GRM32ER71A476ME15L* | GRM32ER70J476ME20L* |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code  
\*: Please refer to GRM Series Specifications and Test Method(2).

(Part Number) 

GR

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①Product ID

②Series

③Dimension (LxW)

④Dimension (T)

⑤Temperature Characteristics

⑥Rated Voltage

⑦Capacitance

⑧Capacitance Tolerance

⑨Individual Specification Code

⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.



## High Dielectric Constant Type X7R(R7)/X7T(D7) Characteristics Low Profile

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 220pF(221)        | ±10%(K)   | GRM15XR71H221KA86D |                    |                    |
| 330pF(331)        | ±10%(K)   | GRM15XR71H331KA86D |                    |                    |
| 470pF(471)        | ±10%(K)   | GRM15XR71H471KA86D |                    |                    |
| 680pF(681)        | ±10%(K)   | GRM15XR71H681KA86D |                    |                    |
| 1000pF(102)       | ±10%(K)   | GRM15XR71H102KA86D |                    |                    |
| 1500pF(152)       | ±10%(K)   | GRM15XR71H152KA86D |                    |                    |
| 2200pF(222)       | ±10%(K)   |                    | GRM15XR71E222KA86D |                    |
| 3300pF(332)       | ±10%(K)   |                    |                    | GRM15XR71C332KA86D |
| 4700pF(472)       | ±10%(K)   |                    |                    | GRM15XR71C472KA86D |
| 6800pF(682)       | ±10%(K)   |                    |                    | GRM15XR71C682KA86D |
| 10000pF(103)      | ±10%(K)   |                    |                    | GRM15XR71C103KA86D |

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              |
| Capacitance       | Tolerance | Part Number         |
| 1.0μF(105)        | ±10%(K)   | GRM185D71A105KE36D* |

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 25(1E)             | 16(1C)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 6800pF(682)       | ±10%(K)   | GRM219R72A682KA01D |                    |                    |                    |
| 33000pF(333)      | ±10%(K)   |                    | GRM219R71H333KA01D |                    |                    |
| 68000pF(683)      | ±10%(K)   |                    |                    | GRM219R71E683KA01D |                    |
| 0.22μF(224)       | ±10%(K)   | GRM21AR72A224KAC5L |                    |                    |                    |
| 0.33μF(334)       | ±10%(K)   | GRM21AR72A334KAC5L | GRM219R71H334KA88D |                    |                    |
| 0.47μF(474)       | ±10%(K)   |                    |                    | GRM219R71E474KA88D |                    |
| 0.68μF(684)       | ±10%(K)   |                    |                    | GRM219R71E684KA88D | GRM219R71C684KA01D |
| 1.0μF(105)        | ±10%(K)   |                    |                    | GRM219R71E105KA88D |                    |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GRM Series Specifications and Test Method(2).

| LxW [mm]          |           | 3.2x1.6(31)<1206>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             | 25(1E)             | 16(1C)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 15000pF(153)      | ±10%(K)   | GRM319R72A153KA01L |                    |                    |                    |
| 22000pF(223)      | ±10%(K)   | GRM31MR72A223KA01L |                    |                    |                    |
| 33000pF(333)      | ±10%(K)   | GRM31MR72A333KA01L |                    |                    |                    |
| 47000pF(473)      | ±10%(K)   | GRM31MR72A473KA01L |                    |                    |                    |
| 68000pF(683)      | ±10%(K)   | GRM31MR72A683KA01L |                    |                    |                    |
| 0.10μF(104)       | ±10%(K)   | GRM319R72A104KA01D |                    |                    |                    |
| 0.15μF(154)       | ±10%(K)   | GRM31MR72A154KA01L | GRM31MR71H154KA01L |                    |                    |
| 0.22μF(224)       | ±10%(K)   | GRM31MR72A224KA01L | GRM31MR71H224KA01L |                    |                    |
| 0.33μF(334)       | ±10%(K)   |                    | GRM319R71H334KA01D |                    |                    |
| 0.47μF(474)       | ±10%(K)   | GRM31MR72A474KA35L | GRM31MR71H474KA01L |                    |                    |
| 0.68μF(684)       | ±10%(K)   | GRM31MR72A684KA35L | GRM31MR71H684KA88L |                    |                    |
| 1.0μF(105)        | ±10%(K)   |                    | GRM31MR71H105KA88L |                    |                    |
| 2.2μF(225)        | ±10%(K)   |                    |                    | GRM31MR71E225KA93L | GRM31MR71C225KA35L |

| LxW [mm]          |           | 3.2x2.5(32)<1210>  |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |
| 0.68μF(684)       | ±10%(K)   | GRM32CR72A684KA01L | GRM32NR71H684KA01L |
| 1.0μF(105)        | ±10%(K)   | GRM32CR72A105KA35L |                    |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## High Dielectric Constant Type X6S(C8) Characteristics

| LxW [mm]          |           | 0.6x0.3(03)<0201>   |                     |
|-------------------|-----------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 6.3(0J)             | 2.5(0E)             |
| Capacitance       | Tolerance | Part Number         |                     |
| 15000pF(153)      | ±10%(K)   | GRM033C80J153KE01D* |                     |
| 22000pF(223)      | ±10%(K)   | GRM033C80J223KE01D* |                     |
| 33000pF(333)      | ±10%(K)   | GRM033C80J333KE01D* |                     |
| 47000pF(473)      | ±10%(K)   | GRM033C80J473KE19D* |                     |
| 0.10μF(104)       | ±10%(K)   | GRM033C80J104KE84D* |                     |
| 0.22μF(224)       | ±10%(K)   |                     | GRM033C80E224ME15D* |

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |                     |                     |
|-------------------|-----------|--------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 25(1E)             | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number        |                     |                     |
| 68000pF(683)      | ±10%(K)   | GRM155C81E683KA12D |                     |                     |
| 0.10μF(104)       | ±10%(K)   | GRM155C81E104KA12D |                     |                     |
| 0.15μF(154)       | ±10%(K)   |                    | GRM155C80J154KE01D* | GRM155C80G154KE01D* |
| 0.22μF(224)       | ±10%(K)   |                    | GRM155C80J224KE01D* | GRM155C80G224KE01D* |
| 0.33μF(334)       | ±10%(K)   |                    | GRM155C80J334KE01D* | GRM155C80G334KE01D* |
| 0.47μF(474)       | ±10%(K)   |                    | GRM155C80J474KE19D* | GRM155C80G474KE01D* |
| 0.68μF(684)       | ±10%(K)   |                    |                     | GRM155C80G684KE19D* |

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |                     |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               | 2.5(0E)             |
| Capacitance       | Tolerance | Part Number         |                     |                     |                     |
| 1.0μF(105)        | ±10%(K)   |                     |                     | GRM188C80G105MA01D  |                     |
| 2.2μF(225)        | ±10%(K)   | GRM188C81A225KE34D* | GRM188C80J225KE19D* |                     |                     |
| 4.7μF(475)        | ±10%(K)   |                     |                     | GRM188C80G475KE19D* |                     |
| 10μF(106)         | ±20%(M)   |                     |                     |                     | GRM188C80E106ME47D* |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |                     |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 25(1E)              | 16(1C)              | 10(1A)              | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |                     |                     |                     |
| 1.0μF(105)        | ±10%(K)   |                     | GRM216C81C105KA12D* |                     |                     |
| 2.2μF(225)        | ±10%(K)   |                     | GRM219C81C225KA12D* |                     |                     |
| 4.7μF(475)        | ±10%(K)   | GRM21BC81E475KA12L* | GRM21BC81C475KA88L* | GRM219C81A475KE34D* | GRM219C80J475KE19D* |
| 10μF(106)         | ±10%(K)   |                     |                     | GRM21BC81A106KE18L* | GRM21BC80J106KE19L* |
|                   |           |                     |                     |                     | GRM219C80J106KE39D* |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |  |
|-------------------|-----------|---------------------|--|
| Rated Volt. [Vdc] |           | 4(0G)               |  |
| Capacitance       | Tolerance | Part Number         |  |
| 10μF(106)         | ±10%(K)   | GRM219C80G106KE19D* |  |
| 22μF(226)         | ±20%(M)   | GRM21BC80G226ME39L* |  |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GRM Series Specifications and Test Method(2).

(Part Number) **GR** **M** **03** **3** **C8** **0J** **153** **K** **E01** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## High Dielectric Constant Type X6S(C8)/X6T(D8) Characteristics

| LxW [mm]          |           | 3.2x1.6(31)<1206>   |                     |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 25(1E)              | 16(1C)              | 10(1A)              | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |                     |                     |                     |
| 2.2μF(225)        | ±10%(K)   |                     | GRM316C81C225KA12D* |                     |                     |
| 4.7μF(475)        | ±10%(K)   |                     | GRM319C81C475KA12D* |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM31CC81E106KE15L* |                     |                     |                     |
| 22μF(226)         | ±20%(M)   |                     |                     | GRM31CC81A226ME19L* | GRM31CC80J226ME19L* |
| 47μF(476)         | ±20%(M)   |                     |                     |                     | GRM31CC80J476ME18L* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>   |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |
| 47μF(476)         | ±20%(M)   | GRM31CC80G476ME19L* |
| 100μF(107)        | ±20%(M)   | GRM31CD80G107ME39L* |

| LxW [mm]          |           | 3.2x2.5(32)<1210>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 25(1E)              | 10(1A)              | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM32DC81E106KA12L  |                     |                     |
| 22μF(226)         | ±20%(M)   | GRM32EC81E226ME15L* |                     |                     |
| 47μF(476)         | ±20%(M)   |                     | GRM32EC81A476ME19L* | GRM32EC80J476ME64L* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GRM Series Specifications and Test Method(2).

## High Dielectric Constant Type X6S(C8) Characteristics Low Profile

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |                     |
|-------------------|-----------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |                     |
| 1.0μF(105)        | ±10%(K)   | GRM185C81A105KE36D* | GRM185C80J105KE26D* |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |                     |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 16(1C)              | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |                     |
| 1.0μF(105)        | ±10%(K)   | GRM216C81C105KA12D* |                     |                     |                     |
| 2.2μF(225)        | ±10%(K)   | GRM219C81C225KA12D* |                     |                     |                     |
| 4.7μF(475)        | ±10%(K)   |                     | GRM219C81A475KE34D* | GRM219C80J475KE19D* |                     |
| 10μF(106)         | ±10%(K)   |                     |                     | GRM219C80J106KE39D* | GRM219C80G106KE19D* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>   |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 16(1C)              |
| Capacitance       | Tolerance | Part Number         |
| 2.2μF(225)        | ±10%(K)   | GRM316C81C225KA12D* |
| 4.7μF(475)        | ±10%(K)   | GRM319C81C475KA12D* |

| LxW [mm]          |           | 3.2x2.5(32)<1210>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 25(1E)             |
| Capacitance       | Tolerance | Part Number        |
| 10μF(106)         | ±10%(K)   | GRM32DC81E106KA12L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GRM Series Specifications and Test Method(2).

| LxW [mm]          |           | 0.6x0.3(03)<0201> |        |                     |                     |
|-------------------|-----------|-------------------|--------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 25(1E)            | 16(1C) | 10(1A)              | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number       |        |                     |                     |
| 100pF(101)        | ±10%(K)   |                   |        |                     |                     |
| 150pF(151)        | ±10%(K)   |                   |        |                     |                     |
| 220pF(221)        | ±10%(K)   |                   |        |                     |                     |
| 330pF(331)        | ±10%(K)   |                   |        |                     |                     |
| 470pF(471)        | ±10%(K)   |                   |        |                     |                     |
| 680pF(681)        | ±10%(K)   |                   |        |                     |                     |
| 1000pF(102)       | ±10%(K)   |                   |        |                     |                     |
| 1500pF(152)       | ±10%(K)   |                   |        | GRM033R61A152KA01D  |                     |
| 2200pF(222)       | ±10%(K)   |                   |        | GRM033R61A222KA01D  |                     |
| 3300pF(332)       | ±10%(K)   |                   |        | GRM033R61A332KA01D  |                     |
| 4700pF(472)       | ±10%(K)   |                   |        | GRM033R61A472KA01D  |                     |
| 6800pF(682)       | ±10%(K)   |                   |        | GRM033R61A682KA01D  |                     |
| 10000pF(103)      | ±10%(K)   |                   |        | GRM033R61A103KA01D  |                     |
| 15000pF(153)      | ±10%(K)   |                   |        |                     | GRM033R60J153KE01D* |
| 22000pF(223)      | ±10%(K)   |                   |        |                     | GRM033R60J223KE01D* |
| 33000pF(333)      | ±10%(K)   |                   |        |                     | GRM033R60J333KE01D* |
| 47000pF(473)      | ±10%(K)   |                   |        |                     | GRM033R60J473KE19D* |
| 0.10μF(104)       | ±10%(K)   |                   |        | GRM033R61A104KE84D* |                     |

\*: Please refer to GRM Series Specifications and Test Method(2).

***muRata***

## High Dielectric Constant Type X5R(R6) Characteristics

| LxW [mm]          |           | 1.0x0.5(15)<0402> |                    |                    |                    |
|-------------------|-----------|-------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)           | 50(1H)             | 25(1E)             | 16(1C)             |
| Capacitance       | Tolerance | Part Number       |                    |                    |                    |
| 220pF(221)        | ±10%(K)   |                   |                    |                    |                    |
| 330pF(331)        | ±10%(K)   |                   |                    |                    |                    |
| 470pF(471)        | ±10%(K)   |                   |                    |                    |                    |
| 680pF(681)        | ±10%(K)   |                   |                    |                    |                    |
| 1000pF(102)       | ±10%(K)   |                   | GRM155R61H102KA01D |                    |                    |
| 1500pF(152)       | ±10%(K)   |                   |                    |                    |                    |
| 2200pF(222)       | ±10%(K)   |                   | GRM155R61H222KA01D |                    |                    |
| 3300pF(332)       | ±10%(K)   |                   |                    |                    |                    |
| 4700pF(472)       | ±10%(K)   |                   | GRM155R61H472KA01D |                    |                    |
| 6800pF(682)       | ±10%(K)   |                   |                    |                    |                    |
| 10000pF(103)      | ±10%(K)   |                   |                    |                    |                    |
| 15000pF(153)      | ±10%(K)   |                   |                    |                    |                    |
| 22000pF(223)      | ±10%(K)   |                   |                    |                    | GRM155R61C223KA01D |
| 33000pF(333)      | ±10%(K)   |                   |                    |                    | GRM155R61C333KA01D |
| 47000pF(473)      | ±10%(K)   |                   |                    |                    | GRM155R61C473KA01D |
| 68000pF(683)      | ±10%(K)   |                   |                    | GRM155R61E683KA87D | GRM155R61C683KA88D |
| 0.10μF(104)       | ±10%(K)   |                   |                    | GRM155R61E104KA87D | GRM155R61C104KA88D |

| LxW [mm]          |           | 1.0x0.5(15)<0402>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 33000pF(333)      | ±10%(K)   | GRM155R61A333KA01D  |                     |                     |
| 47000pF(473)      | ±10%(K)   | GRM155R61A473KA01D  |                     |                     |
| 68000pF(683)      | ±10%(K)   | GRM155R61A683KA01D  |                     |                     |
| 0.10μF(104)       | ±10%(K)   | GRM155R61A104KA01D  |                     |                     |
| 0.15μF(154)       | ±10%(K)   | GRM155R61A154KE19D* | GRM155R60J154KE01D* |                     |
| 0.22μF(224)       | ±10%(K)   | GRM155R61A224KE19D* | GRM155R60J224KE01D* |                     |
| 0.33μF(334)       | ±10%(K)   | GRM155R61A334KE15D* | GRM155R60J334KE01D* |                     |
| 0.47μF(474)       | ±10%(K)   | GRM155R61A474KE15D* | GRM155R60J474KE19D* |                     |
| 0.68μF(684)       | ±10%(K)   | GRM155R61A684KE15D* | GRM155R60J684KE19D* |                     |
| 1.0μF(105)        | ±10%(K)   | GRM155R61A105KE15D* |                     |                     |
| 4.7μF(475)        | ±20%(M)   |                     |                     | GRM155R60G475ME87D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

[ ]: Please refer to X7R(R7) etc Characteristics.

\*: Please refer to GRM Series Specifications and Test Method(2).

## High Dielectric Constant Type X5R(R6) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603> |                    |                     |                     |
|-------------------|-----------|-------------------|--------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)           | 50(1H)             | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number       |                    |                     |                     |
| 220pF(221)        | ±10%(K)   |                   |                    |                     |                     |
| 330pF(331)        | ±10%(K)   |                   |                    |                     |                     |
| 470pF(471)        | ±10%(K)   |                   |                    |                     |                     |
| 680pF(681)        | ±10%(K)   |                   |                    |                     |                     |
| 1000pF(102)       | ±10%(K)   |                   | GRM188R61H102KA01D |                     |                     |
| 1500pF(152)       | ±10%(K)   |                   |                    |                     |                     |
| 2200pF(222)       | ±10%(K)   |                   | GRM188R61H222KA01D |                     |                     |
| 3300pF(332)       | ±10%(K)   |                   |                    |                     |                     |
| 4700pF(472)       | ±10%(K)   |                   | GRM188R61H472KA01D |                     |                     |
| 6800pF(682)       | ±10%(K)   |                   |                    |                     |                     |
| 10000pF(103)      | ±10%(K)   |                   | GRM188R61H103KA01D |                     |                     |
| 15000pF(153)      | ±10%(K)   |                   |                    |                     |                     |
| 22000pF(223)      | ±10%(K)   |                   | GRM188R61H223KA01D |                     |                     |
| 33000pF(333)      | ±10%(K)   |                   |                    |                     |                     |
| 47000pF(473)      | ±10%(K)   |                   |                    |                     |                     |
| 68000pF(683)      | ±10%(K)   |                   |                    |                     |                     |
| 0.10μF(104)       | ±10%(K)   |                   |                    | GRM188R61E104KA01D  | GRM188R61C104KA01D  |
| 0.15μF(154)       | ±10%(K)   |                   |                    |                     |                     |
| 0.22μF(224)       | ±10%(K)   |                   |                    | GRM188R61E224KA88D  | GRM188R61C224KA88D  |
| 0.33μF(334)       | ±10%(K)   |                   |                    |                     |                     |
| 0.47μF(474)       | ±10%(K)   |                   |                    | GRM188R61E474KA12D* | GRM188R61C474KA93D* |
| 1.0μF(105)        | ±10%(K)   |                   |                    | GRM188R61E105KA12D* | GRM188R61C105KA93D* |
| 2.2μF(225)        | ±10%(K)   |                   |                    |                     | GRM188R61C225KE15D* |

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 0.15μF(154)       | ±10%(K)   | GRM188R61A154KA01D  |                     |                     |
| 0.22μF(224)       | ±10%(K)   | GRM188R61A224KA01D  |                     |                     |
| 0.33μF(334)       | ±10%(K)   |                     |                     |                     |
| 0.47μF(474)       | ±10%(K)   | GRM188R61A474KA61D  |                     |                     |
| 0.68μF(684)       | ±10%(K)   |                     |                     |                     |
| 2.2μF(225)        | ±10%(K)   | GRM188R61A225KE34D* |                     |                     |
| 4.7μF(475)        | ±10%(K)   |                     | GRM188R60J475KE19D* |                     |
| 10μF(106)         | ±20%(M)   |                     | GRM188R60J106ME47D* | GRM188R60G106ME47D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

[ ]: Please refer to X7R(R7) etc Characteristics.

\*: Please refer to GRM Series Specifications and Test Method(2).

(Part Number) **GR** **M** **18** **8** **R6** **1H** **102** **K** **A01** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## High Dielectric Constant Type X5R(R6) Characteristics

| LxW [mm]          |           | 2.0x1.25(21)<0805> |        |                     |                     |
|-------------------|-----------|--------------------|--------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H) | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number        |        |                     |                     |
| 6800pF(682)       | ±10%(K)   |                    |        |                     |                     |
| 10000pF(103)      | ±10%(K)   |                    |        |                     |                     |
| 15000pF(153)      | ±10%(K)   |                    |        |                     |                     |
| 22000pF(223)      | ±10%(K)   |                    |        |                     |                     |
| 33000pF(333)      | ±10%(K)   |                    |        |                     |                     |
| 47000pF(473)      | ±10%(K)   |                    |        |                     |                     |
| 68000pF(683)      | ±10%(K)   |                    |        |                     |                     |
| 0.10μF(104)       | ±10%(K)   |                    |        |                     |                     |
| 0.15μF(154)       | ±10%(K)   |                    |        |                     |                     |
| 0.22μF(224)       | ±10%(K)   |                    |        |                     |                     |
| 0.33μF(334)       | ±10%(K)   |                    |        |                     | GRM21BR61C334KA01L  |
| 0.47μF(474)       | ±10%(K)   |                    |        |                     | GRM21BR61C474KA01L  |
| 0.68μF(684)       | ±10%(K)   |                    |        |                     |                     |
| 1.0μF(105)        | ±10%(K)   |                    |        | GRM216R61E105KA12D  | GRM21BR61C105KA01L  |
| 2.2μF(225)        | ±10%(K)   |                    |        | GRM21BR61E225KA12L  | GRM21BR61C225KA88L* |
|                   |           |                    |        | GRM219R61E225KA12D* | GRM219R61C225KA88D* |
| 4.7μF(475)        | ±10%(K)   |                    |        | GRM21BR61E475KA12L* | GRM21BR61C475KA88L* |
|                   |           |                    |        |                     | GRM219R61C475KE15D* |
| 10μF(106)         | ±10%(K)   |                    |        |                     | GRM21BR61C106KE15L* |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 2.2μF(225)        | ±10%(K)   | GRM21BR61A225KA01L  |                     |                     |
| 4.7μF(475)        | ±10%(K)   | GRM219R61A475KE34D* |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM21BR61A106KE19L* | GRM219R60J106KE19D* |                     |
|                   |           | GRM219R61A106KE44D* |                     |                     |
| 22μF(226)         | ±20%(M)   |                     | GRM21BR60J226ME39L* | GRM219R60G226ME66D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

[ ]: Please refer to X7R(R7) etc Characteristics.

\*: Please refer to GRM Series Specifications and Test Method(2).

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High Dielectric Constant Type X5R(R6) Characteristics

| LxW [mm]          |           | 3.2x1.6(31)<1206> |                    |                     |                     |
|-------------------|-----------|-------------------|--------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)           | 50(1H)             | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number       |                    |                     |                     |
| 15000pF(153)      | ±10%(K)   |                   |                    |                     |                     |
| 22000pF(223)      | ±10%(K)   |                   |                    |                     |                     |
| 33000pF(333)      | ±10%(K)   |                   |                    |                     |                     |
| 47000pF(473)      | ±10%(K)   |                   |                    |                     |                     |
| 68000pF(683)      | ±10%(K)   |                   |                    |                     |                     |
| 0.10μF(104)       | ±10%(K)   |                   |                    |                     |                     |
| 0.15μF(154)       | ±10%(K)   |                   |                    |                     |                     |
| 0.22μF(224)       | ±10%(K)   |                   |                    |                     |                     |
| 0.33μF(334)       | ±10%(K)   |                   |                    |                     |                     |
| 0.47μF(474)       | ±10%(K)   |                   |                    |                     |                     |
| 0.68μF(684)       | ±10%(K)   |                   |                    |                     |                     |
| 1.0μF(105)        | ±10%(K)   |                   |                    |                     |                     |
| 2.2μF(225)        | ±10%(K)   |                   | GRM31CR61H225KA88L | GRM316R61E225KA12D* |                     |
| 4.7μF(475)        | ±10%(K)   |                   |                    | GRM31CR61E475KA88L  | GRM31CR61C475KA01L  |
|                   |           |                   |                    | GRM319R61E475KA12D* | GRM319R61C475KA88D* |
| 10μF(106)         | ±10%(K)   |                   |                    | GRM31CR61E106KA12L* | GRM31CR61C106KA88L  |
|                   |           |                   |                    |                     | GRM319R61C106KE15D* |
| 22μF(226)         | ±20%(M)   |                   |                    |                     | GRM31CR61C226ME15L* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>   |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM319R61A106KE19L* |                     |                     |
| 22μF(226)         | ±20%(M)   | GRM31CR61A226ME19L* | GRM31CR60J226ME19L* |                     |
| 47μF(476)         | ±20%(M)   |                     | GRM31CR60J476ME19L* |                     |
| 100μF(107)        | ±20%(M)   |                     | GRM31CR60J107ME39L* | GRM31CR60G107ME39L* |

| LxW [mm]          |           | 3.2x2.5(32)<1210> |        |                    |                     |
|-------------------|-----------|-------------------|--------|--------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)           | 50(1H) | 35(YA)             | 25(1E)              |
| Capacitance       | Tolerance | Part Number       |        |                    |                     |
| 0.68μF(684)       | ±10%(K)   |                   |        |                    |                     |
| 1.0μF(105)        | ±10%(K)   |                   |        |                    |                     |
| 2.2μF(225)        | ±10%(K)   |                   |        |                    |                     |
| 4.7μF(475)        | ±10%(K)   |                   |        |                    |                     |
| 10μF(106)         | ±10%(K)   |                   |        | GRM32ER6YA106KA12L | GRM32DR61E106KA12L  |
| 22μF(226)         | ±20%(M)   |                   |        |                    | GRM32ER61E226ME15L* |

| LxW [mm]          |           | 3.2x2.5(32)<1210>   |                     |         |
|-------------------|-----------|---------------------|---------------------|---------|
| Rated Volt. [Vdc] |           | 16(1C)              | 10(1A)              | 6.3(0J) |
| Capacitance       | Tolerance | Part Number         |                     |         |
| 22μF(226)         | ±20%(M)   |                     |                     |         |
| 47μF(476)         | ±20%(M)   | GRM32ER61C476ME15L* | GRM32ER61A476ME20L* |         |

The part number code is shown in ( ) and Unit is shown in [ ].
< >: EIA [inch] Code  
: Please refer to X7R(R7) etc Characteristics.  
\*: Please refer to GRM Series Specifications and Test Method(2).

(Part Number)

GR

M

31

C

R6

1H

225

K

A88

L

1

2

3

4

5

6

7

8

9

10

1Product ID
2Series
3Dimension (LxW)
4Dimension (T)
5Temperature Characteristics
6Rated Voltage
7Capacitance
8Capacitance Tolerance
9Individual Specification Code
10Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## High Dielectric Constant Type X5R(R6) Characteristics Low Profile

| LxW [mm]          |           | 1.0x0.5(15)<0402> |        |        |
|-------------------|-----------|-------------------|--------|--------|
| Rated Volt. [Vdc] |           | 16(1C)            | 25(1E) | 16(1C) |
| Capacitance       | Tolerance | Part Number       |        |        |
| 220pF(221)        | ±10%(K)   |                   |        |        |
| 330pF(331)        | ±10%(K)   |                   |        |        |
| 470pF(471)        | ±10%(K)   |                   |        |        |
| 680pF(681)        | ±10%(K)   |                   |        |        |
| 1000pF(102)       | ±10%(K)   |                   |        |        |
| 1500pF(152)       | ±10%(K)   |                   |        |        |
| 2200pF(222)       | ±10%(K)   |                   |        |        |
| 3300pF(332)       | ±10%(K)   |                   |        |        |
| 4700pF(472)       | ±10%(K)   |                   |        |        |
| 6800pF(682)       | ±10%(K)   |                   |        |        |
| 10000pF(103)      | ±10%(K)   |                   |        |        |

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |                     |
|-------------------|-----------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 16(1C)              | 10(1A)              |
| Capacitance       | Tolerance | Part Number         |                     |
| 1.0μF(105)        | ±10%(K)   | GRM185R61C105KE44D* | GRM185R61A105KE36D* |

| LxW [mm]          |           | 2.0x1.25(21)<0805> |        |                     |                     |
|-------------------|-----------|--------------------|--------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)            | 50(1H) | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number        |        |                     |                     |
| 6800pF(682)       | ±10%(K)   |                    |        |                     |                     |
| 33000pF(333)      | ±10%(K)   |                    |        |                     |                     |
| 68000pF(683)      | ±10%(K)   |                    |        |                     |                     |
| 0.22μF(224)       | ±10%(K)   |                    |        |                     |                     |
| 0.33μF(334)       | ±10%(K)   |                    |        |                     |                     |
| 0.47μF(474)       | ±10%(K)   |                    |        |                     |                     |
| 0.68μF(684)       | ±10%(K)   |                    |        |                     |                     |
| 1.0μF(105)        | ±10%(K)   |                    |        | GRM216R61E105KA12D  |                     |
| 2.2μF(225)        | ±10%(K)   |                    |        | GRM219R61E225KA12D* | GRM219R61C225KA88D* |
| 4.7μF(475)        | ±10%(K)   |                    |        |                     | GRM219R61C475KE15D* |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |                     |                     |
|-------------------|-----------|---------------------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |                     |                     |
| 4.7μF(475)        | ±10%(K)   | GRM219R61A475KE34D* |                     |                     |
| 10μF(106)         | ±10%(K)   | GRM219R61A106KE44D* | GRM219R60J106KE19D* |                     |
| 22μF(226)         | ±20%(M)   |                     |                     | GRM219R60G226ME66D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

[ ]: Please refer to X7R(R7) etc Characteristics.

\*: Please refer to GRM Series Specifications and Test Method(2).

1

## High Dielectric Constant Type X5R(R6) Characteristics Low Profile

| LxW [mm]          |           | 3.2x1.6(31)<1206> |        |                     |                     |
|-------------------|-----------|-------------------|--------|---------------------|---------------------|
| Rated Volt. [Vdc] |           | 100(2A)           | 50(1H) | 25(1E)              | 16(1C)              |
| Capacitance       | Tolerance | Part Number       |        |                     |                     |
| 15000pF(153)      | ±10%(K)   |                   |        |                     |                     |
| 22000pF(223)      | ±10%(K)   |                   |        |                     |                     |
| 33000pF(333)      | ±10%(K)   |                   |        |                     |                     |
| 47000pF(473)      | ±10%(K)   |                   |        |                     |                     |
| 68000pF(683)      | ±10%(K)   |                   |        |                     |                     |
| 0.10μF(104)       | ±10%(K)   |                   |        |                     |                     |
| 0.15μF(154)       | ±10%(K)   |                   |        |                     |                     |
| 0.22μF(224)       | ±10%(K)   |                   |        |                     |                     |
| 0.33μF(334)       | ±10%(K)   |                   |        |                     |                     |
| 0.47μF(474)       | ±10%(K)   |                   |        |                     |                     |
| 0.68μF(684)       | ±10%(K)   |                   |        |                     |                     |
| 1.0μF(105)        | ±10%(K)   |                   |        |                     |                     |
| 2.2μF(225)        | ±10%(K)   |                   |        | GRM316R61E225KA12D* |                     |
| 4.7μF(475)        | ±10%(K)   |                   |        | GRM319R61E475KA12D* | GRM319R61C475KA88D* |
| 10μF(106)         | ±10%(K)   |                   |        |                     | GRM319R61C106KE15D* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>   |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 10(1A)              |
| Capacitance       | Tolerance | Part Number         |
| 10μF(106)         | ±10%(K)   | GRM319R61A106KE19D* |

| LxW [mm]          |           | 3.2x2.5(32)<1210> |        |                    |
|-------------------|-----------|-------------------|--------|--------------------|
| Rated Volt. [Vdc] |           | 100(2A)           | 50(1H) | 25(1E)             |
| Capacitance       | Tolerance | Part Number       |        |                    |
| 0.68μF(684)       | ±10%(K)   |                   |        |                    |
| 1.0μF(105)        | ±10%(K)   |                   |        |                    |
| 10μF(106)         | ±10%(K)   |                   |        | GRM32DR61E106KA12L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

[ ]: Please refer to X7R(R7) etc Characteristics.

\*: Please refer to GRM Series Specifications and Test Method(2).

(Part Number) **GR** **M** **31** **6** **R6** **1E** **225** **K** **A12** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## GRM Series Specifications and Test Methods (1) (Note1) Typical Inspection

1

(Note1) This Specifications and Test Methods indicates typical inspection.  
 Please refer to individual specifications (our product specifications or the approval sheet).  
 In case Non "\*\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (1).  
 In case "\*\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

| No. | Item                            | Specifications                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                    | Test Method                                                                                                                                                                                                                                                                                |
|-----|---------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                 | Temperature Compensating Type                                                            | High Dielectric Type                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                            |
| 1   | Operating Temperature Range     | -55 to +125°C<br>(2P/R/S/T, 3P/R/S/T/U,<br>4P/R/S/T/U: -25 to +85°C)                     | B1, B3, F1: -25 to +85°C<br>R1, R7: -55 to +125°C<br>R6: -55 to +85°C<br>C8: -55 to +105°C<br>E4: +10 to +85°C<br>F5: -30 to +85°C                                                                                                                                                                                                                                                                                                 | Reference temperature: 25°C<br>(2Δ, 3Δ, 4Δ, B1, B3, F1, R1: 20°C)                                                                                                                                                                                                                          |
| 2   | Rated Voltage                   | See the previous pages.                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                    | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.                               |
| 3   | Appearance                      | No defects or abnormalities                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                    | Visual inspection                                                                                                                                                                                                                                                                          |
| 4   | Dimensions                      | Within the specified dimensions                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                    | Using calipers (GRM02 size is based on Microscope)                                                                                                                                                                                                                                         |
| 5   | Dielectric Strength             | No defects or abnormalities                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                    | No failure should be observed when 300%* of the rated voltage (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V |
| 6   | Insulation Resistance           | C≤0.047μF: More than 10,000MΩ<br>C>0.047μF: More than 500Ω · F<br>C: Nominal Capacitance |                                                                                                                                                                                                                                                                                                                                                                                                                                    | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20/25°C and 75%RH max. and within 2 minutes of charging, provided the charge/discharge current is less than 50mA.                                                                        |
| 7   | Capacitance                     | Within the specified tolerance                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                    | The capacitance/Q/D.F. should be measured at 20/25°C at the frequency and voltage shown in the table.                                                                                                                                                                                      |
| 8   | Q/<br>Dissipation Factor (D.F.) | 30pF and over: Q≥1000<br>30pF and below: Q≥400+20C<br>C: Nominal Capacitance (pF)        | [R6, R7, C8]<br>W.V.: 100V<br>: 0.025 max. (C<0.068μF)<br>: 0.05 max. (C≥0.068μF)<br>W.V.: 50/35/25V:<br>: 0.025 max.*<br>*GRM32D R7/R6/C8 1E106: 0.035 max.<br>W.V.: 16/10V: 0.035 max.<br>W.V.: 6.3/4V<br>: 0.05 max. (C<3.3μF)<br>: 0.1 max. (C≥3.3μF)<br>[E4]<br>W.V.: 25Vmin: 0.025 max.<br>[F1, F5]<br>W.V.: 25V min.<br>: 0.05 max. (C<0.1μF)<br>: 0.09 max. (C≥0.1μF)<br>W.V.: 16/10V: 0.125 max.<br>W.V.: 6.3V: 0.15 max. |                                                                                                                                                                                                                                                                                            |

| Char.<br>Item | ΔC<br>to 7U, 1X<br>(1000pF and<br>below) | ΔC to 7U, 1X<br>(more than<br>1000pF)<br>R6, R7, C8,<br>F5, B1, B3, F1 | R6, R7, F5<br>(C>10μF) | E4               |
|---------------|------------------------------------------|------------------------------------------------------------------------|------------------------|------------------|
| Frequency     | 1±0.1MHz                                 | 1±0.1kHz                                                               | 120±24kHz              | 1±0.1kHz         |
| Voltage       | 0.5 to 5Vrms                             | 1±0.2Vrms                                                              | 0.5±<br>0.1Vrms        | 0.5±<br>0.05Vrms |

Continued on the following page. 

## GRM Series Specifications and Test Methods (1) (Note1) Typical Inspection

(Note1) This Specifications and Test Methods indicates typical inspection.

Please refer to individual specifications (our product specifications or the approval sheet).

In case Non "\*\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (1).

In case "\*\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

Continued from the preceding page.

| No.   | Item                                                                                   |                                                                                             | Specifications                                               |                                                                                                                                                                                                                                                                                                               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
|-------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|---|-------------------------------|-------|----------------------------------------------------------------------------------------|------|-------------------------------|-------|----------------------------------------------------------|-----|-------------------------------|-------|------------------|----------------------|-----|-------------------------------|---------|-----|--------------------------------------------------------------------------------------|-------|-------------------------------|-----|---------------------------------------------------------------------------|-------|-------------------------------|--------------------------|-----|---------------------------------------|-----|-------------------------------|-----|--------------------------------------|-----|-----|-----|-------|-----|-----|-----|
|       |                                                                                        |                                                                                             | Temperature Compensating Type                                | High Dielectric Type                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 9     | Capacitance Temperature Characteristics                                                | No bias                                                                                     | Within the specified tolerance (Table A-1)                   | B1, B3: Within $\pm 10\%$<br>(−25 to +85°C)<br>R1, R7: Within $\pm 15\%$<br>(−55 to +125°C)<br>R6: Within $\pm 15\%$<br>(−55 to +85°C)<br>E4: Within +22/−56%<br>(+10 to +85°C)<br>F1: Within +30/−80%<br>(−25 to +85°C)<br>F5: Within +22/−82%<br>(−30 to +85°C)<br>C8: Within $\pm 22\%$<br>(−55 to +105°C) | <p>The capacitance change should be measured after 5 min. at each specified temp. stage.</p> <p>(1)Temperature Compensating Type</p> <p>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.</p> <p>When cycling the temperature sequentially from step 1 through 5 (5C: +25 to +125°C/ΔC: +20 to +125°C: other temp. coeffs.: +25 to +85°C/+20 to +85°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1.</p> <p>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.</p> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>Reference Temperature <math>\pm 2</math></td></tr><tr><td>2</td><td>−55±3 (for ΔC to 7U/R6/R7/C8)<br/>−30±3 (for F5), 10±3 (for E4)<br/>−25±3 (for other TC)</td></tr><tr><td>3</td><td>Reference Temperature <math>\pm 2</math></td></tr><tr><td>4</td><td>125±3 (for ΔC/R7), 105±3 (for C8)<br/>85±3 (for other TC)</td></tr><tr><td>5</td><td>Reference Temperature <math>\pm 2</math></td></tr></table> <p>(2) High Dielectric Constant Type</p> <p>The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.*</p> <p>In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr><tr><td>1</td><td>Reference Temperature <math>\pm 2</math></td><td rowspan="4">No bias</td></tr><tr><td>2</td><td>−55±3 (for C8, R1, R7, R6)<br/>−25±3 (for B1, B3, F1)<br/>−30±3 (for F5)/10±3 (for E4)</td></tr><tr><td>3</td><td>Reference Temperature <math>\pm 2</math></td></tr><tr><td>4</td><td>125±3 (for R1, R7)/<br/>85±3 (for B1, B3, R6<br/>F1, F5, E4)/105±3 (for C8)</td></tr><tr><td>5</td><td>Reference Temperature <math>\pm 2</math></td><td rowspan="3">50% of the rated voltage</td></tr><tr><td>6</td><td>−55±3 (for R1)/<br/>−25±3 (for B1, F1)</td></tr><tr><td>7</td><td>Reference Temperature <math>\pm 2</math></td></tr><tr><td>8</td><td>125±3 (for R1)/<br/>85±3 (for B1, F1)</td><td></td></tr></table> | Step | Temperature (°C) | 1 | Reference Temperature $\pm 2$ | 2     | −55±3 (for ΔC to 7U/R6/R7/C8)<br>−30±3 (for F5), 10±3 (for E4)<br>−25±3 (for other TC) | 3    | Reference Temperature $\pm 2$ | 4     | 125±3 (for ΔC/R7), 105±3 (for C8)<br>85±3 (for other TC) | 5   | Reference Temperature $\pm 2$ | Step  | Temperature (°C) | Applying Voltage (V) | 1   | Reference Temperature $\pm 2$ | No bias | 2   | −55±3 (for C8, R1, R7, R6)<br>−25±3 (for B1, B3, F1)<br>−30±3 (for F5)/10±3 (for E4) | 3     | Reference Temperature $\pm 2$ | 4   | 125±3 (for R1, R7)/<br>85±3 (for B1, B3, R6<br>F1, F5, E4)/105±3 (for C8) | 5     | Reference Temperature $\pm 2$ | 50% of the rated voltage | 6   | −55±3 (for R1)/<br>−25±3 (for B1, F1) | 7   | Reference Temperature $\pm 2$ | 8   | 125±3 (for R1)/<br>85±3 (for B1, F1) |     |     |     |       |     |     |     |
|       |                                                                                        | Step                                                                                        | Temperature (°C)                                             |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
|       |                                                                                        | 1                                                                                           | Reference Temperature $\pm 2$                                |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 2     | −55±3 (for ΔC to 7U/R6/R7/C8)<br>−30±3 (for F5), 10±3 (for E4)<br>−25±3 (for other TC) |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 3     | Reference Temperature $\pm 2$                                                          |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 4     | 125±3 (for ΔC/R7), 105±3 (for C8)<br>85±3 (for other TC)                               |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 5     | Reference Temperature $\pm 2$                                                          |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| Step  | Temperature (°C)                                                                       | Applying Voltage (V)                                                                        |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 1     | Reference Temperature $\pm 2$                                                          | No bias                                                                                     |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 2     | −55±3 (for C8, R1, R7, R6)<br>−25±3 (for B1, B3, F1)<br>−30±3 (for F5)/10±3 (for E4)   |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 3     | Reference Temperature $\pm 2$                                                          |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 4     | 125±3 (for R1, R7)/<br>85±3 (for B1, B3, R6<br>F1, F5, E4)/105±3 (for C8)              |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 5     | Reference Temperature $\pm 2$                                                          | 50% of the rated voltage                                                                    |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 6     | −55±3 (for R1)/<br>−25±3 (for B1, F1)                                                  |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 7     | Reference Temperature $\pm 2$                                                          |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 8     | 125±3 (for R1)/<br>85±3 (for B1, F1)                                                   |                                                                                             |                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
|       | 50% of the Rated Voltage                                                               |                                                                                             |                                                              | B1: Within +10/−30%<br>R1: Within +15/−40%<br>F1: Within +30/−95%                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
|       | Capacitance Drift                                                                      | Within $\pm 0.2\%$ or $\pm 0.05\text{pF}$ (Whichever is larger.)<br>*Do not apply to 1X/25V |                                                              | *Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150+0/−10°C for one hour and then set for 24±2 hours at room temperature.<br>Perform the initial measurement.                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| 10    | Adhesive Strength of Termination                                                       |                                                                                             | No removal of the terminations or other defect should occur. |                                                                                                                                                                                                                                                                                                               | <p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec.</p> <p>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p>*1N (GRM02), 2N (GRM03), 5N (GRM15, GRM18)</p> <p>(in mm)</p> <table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GRM02</td><td>0.2</td><td>0.56</td><td>0.23</td></tr><tr><td>GRM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GRM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Type | a                | b | c                             | GRM02 | 0.2                                                                                    | 0.56 | 0.23                          | GRM03 | 0.3                                                      | 0.9 | 0.3                           | GRM15 | 0.4              | 1.5                  | 0.5 | GRM18                         | 1.0     | 3.0 | 1.2                                                                                  | GRM21 | 1.2                           | 4.0 | 1.65                                                                      | GRM31 | 2.2                           | 5.0                      | 2.0 | GRM32                                 | 2.2 | 5.0                           | 2.9 | GRM43                                | 3.5 | 7.0 | 3.7 | GRM55 | 4.5 | 8.0 | 5.6 |
| Type  | a                                                                                      | b                                                                                           | c                                                            |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM02 | 0.2                                                                                    | 0.56                                                                                        | 0.23                                                         |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM03 | 0.3                                                                                    | 0.9                                                                                         | 0.3                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM15 | 0.4                                                                                    | 1.5                                                                                         | 0.5                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM18 | 1.0                                                                                    | 3.0                                                                                         | 1.2                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM21 | 1.2                                                                                    | 4.0                                                                                         | 1.65                                                         |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM31 | 2.2                                                                                    | 5.0                                                                                         | 2.0                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM32 | 2.2                                                                                    | 5.0                                                                                         | 2.9                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM43 | 3.5                                                                                    | 7.0                                                                                         | 3.7                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |
| GRM55 | 4.5                                                                                    | 8.0                                                                                         | 5.6                                                          |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                  |   |                               |       |                                                                                        |      |                               |       |                                                          |     |                               |       |                  |                      |     |                               |         |     |                                                                                      |       |                               |     |                                                                           |       |                               |                          |     |                                       |     |                               |     |                                      |     |     |     |       |     |     |     |

Continued on the following page.

# GRM Series Specifications and Test Methods (1) (Note1) Typical Inspection

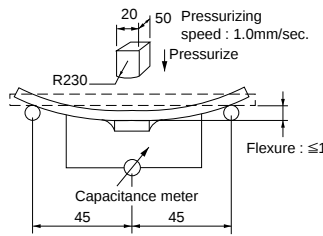
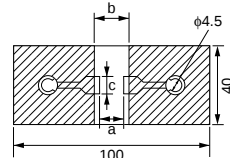
(Note1) This Specifications and Test Methods indicates typical inspection.

Please refer to individual specifications (our product specifications or the approval sheet).

In case Non "\*\*\*" is added in PN's table, please refer to GRM Series Specifications and Test Methods (1).

In case "\*\*\*" is added in PN's table, please refer to GRM Series Specifications and Test Methods (2).

Continued from the preceding page.

| No.   | Item                         | Specifications                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|-------|------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|-------|-----|------|------|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|------|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|
|       |                              | Temperature Compensating Type                                                                                     | High Dielectric Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| 11    | Vibration Resistance         | Appearance                                                                                                        | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|       |                              | Capacitance                                                                                                       | Within the specified tolerance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|       |                              | Q/D.F.                                                                                                            | <div>[B1, B3, R6, R7, C8]<br/>W.V.: 100V<br/>: 0.025 max. (C&lt;0.068μF)<br/>: 0.05 max. (C≥0.068μF)<br/>W.V.: 50/35/25V:<br/>: 0.025 max.*<br/>*GRM32D R7/R6/C8 1E106: 0.035 max.<br/>W.V.: 16/10V: 0.035 max.<br/>W.V.: 6.3/4V<br/>: 0.05 max. (C&lt;3.3μF)<br/>: 0.1 max. (C≥3.3μF)<br/>[E4]<br/>W.V.: 25Vmin: 0.025 max.<br/>[F1, F5]<br/>W.V.: 25V min.<br/>: 0.05 max. (C&lt;0.1μF)<br/>: 0.09 max. (C≥0.1μF)<br/>W.V.: 16/10V: 0.125 max.<br/>W.V.: 6.3V: 0.15 max.</div> <div>30pF and over: Q≥1000<br/>30pF and below:<br/>Q≥400+20C<br/><br/>C: Nominal Capacitance (pF)</div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| 12    | Deflection                   | Appearance                                                                                                        | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|       |                              | Capacitance Change                                                                                                | Within ±5% or ±0.5pF (Whichever is larger)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Within ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|       |                              | <div></div> <div>Fig. 3a</div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| 13    | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously.                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <div>Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</div> <div></div> <div>Fig. 2a</div> <div>t: 1.6mm (GRM02/03/15: t: 0.8mm)</div> <table><thead><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr></thead><tbody><tr><td>GRM02</td><td>0.2</td><td>0.56</td><td>0.23</td></tr><tr><td>GRM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GRM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></tbody></table> <div>(in mm)</div> | Type | a | b | c | GRM02 | 0.2 | 0.56 | 0.23 | GRM03 | 0.3 | 0.9 | 0.3 | GRM15 | 0.4 | 1.5 | 0.5 | GRM18 | 1.0 | 3.0 | 1.2 | GRM21 | 1.2 | 4.0 | 1.65 | GRM31 | 2.2 | 5.0 | 2.0 | GRM32 | 2.2 | 5.0 | 2.9 | GRM43 | 3.5 | 7.0 | 3.7 | GRM55 | 4.5 | 8.0 | 5.6 |
|       |                              | Type                                                                                                              | a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | c    |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|       |                              | GRM02                                                                                                             | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.23 |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM03 | 0.3                          | 0.9                                                                                                               | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM15 | 0.4                          | 1.5                                                                                                               | 0.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM18 | 1.0                          | 3.0                                                                                                               | 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM21 | 1.2                          | 4.0                                                                                                               | 1.65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM31 | 2.2                          | 5.0                                                                                                               | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM32 | 2.2                          | 5.0                                                                                                               | 2.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM43 | 3.5                          | 7.0                                                                                                               | 3.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM55 | 4.5                          | 8.0                                                                                                               | 5.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |

Continued on the following page.

## GRM Series Specifications and Test Methods (1) (Note1) Typical Inspection

(Note1) This Specifications and Test Methods indicates typical inspection.

Please refer to individual specifications (our product specifications or the approval sheet).

In case Non "\*\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (1).

In case "\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

Continued from the preceding page.

| No.         | Item                         | Specifications                |                                                                                                     | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|-------------|------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|------|---|--------------|------------|----------------------------|--------------|----------------------------|------------|-------------|------|--------|------|--------|
|             |                              | Temperature Compensating Type | High Dielectric Type                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 14          | Resistance to Soldering Heat |                               | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Appearance                    | No defects or abnormalities                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Capacitance Change            | Within ±2.5% or ±0.25pF (Whichever is larger)                                                       | B1, B3, R1, R6, R7, C8 : Within ±7.5%<br>F1, F5, E4: Within ±20%                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Q/D.F.                        | 30pF and over: Q≥1000<br>30pF and below: Q≥400+20C<br><br>C: Nominal Capacitance (pF)               | [B1, B3, R6, R7, C8]<br>W.V.: 100V<br>: 0.025 max. (C<0.068μF)<br>: 0.05 max. (C≥0.068μF)<br>W.V.: 50/35/25V:<br>: 0.025 max.*<br>*GRM32D R7/R6/C8 1E106: 0.035 max.<br>W.V.: 16/10V: 0.035 max.<br>W.V.: 6.3/4V<br>: 0.05 max. (C<3.3μF)<br>: 0.1 max. (C≥3.3μF)<br>[E4]<br>W.V.: 25Vmin: 0.025 max.<br>[F1, F5]<br>W.V.: 25V min.<br>: 0.05 max. (C<0.1μF)<br>: 0.09 max. (C≥0.1μF)<br>W.V.: 16/10V: 0.125 max.<br>W.V.: 6.3V: 0.15 max.                              |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | I.R.                          | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Dielectric Strength           | No defects                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 15          | Temperature Cycle            |                               | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Appearance                    | No defects or abnormalities                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Capacitance Change            | Within ±2.5% or ±0.25pF (Whichever is larger)                                                       | B1, B3, R1, R6, R7, C8 : Within ±7.5%<br>F1, F5, E4: Within ±20%                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Q/D.F.                        | 30pF and over: Q≥1000<br>30pF and below: Q≥400+20C<br><br>C: Nominal Capacitance (pF)               | [B1, B3, R6, R7, C8]<br>W.V.: 100V<br>: 0.025 max. (C<0.068μF)<br>: 0.05 max. (C≥0.068μF)<br>W.V.: 50/35/25V:<br>: 0.025 max.*<br>*GRM32D R7/R6/C8 1E106: 0.035 max.<br>W.V.: 16/10V: 0.035 max.<br>W.V.: 6.3/4V<br>: 0.05 max. (C<3.3μF)<br>: 0.1 max. (C≥3.3μF)<br>[E4]<br>W.V.: 25Vmin: 0.05 max.<br>[F1, F5]<br>W.V.: 25V min.<br>: 0.05 max. (C<0.1μF)<br>: 0.09 max. (C≥0.1μF)<br>W.V.: 16/10V: 0.125 max.<br>W.V.: 6.3V: 0.15 max.                               |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | I.R.                          | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              | Dielectric Strength           | No defects                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     | Preheat the capacitor at 120 to 150°C for 1 minute.<br>Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure.<br><br>•Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours.<br>Perform the initial measurement.<br><br>•Preheating for GRM32/43/55 |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     | <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                                                                                                    | Step | Temperature | Time | 1 | 100 to 120°C | 1 min.     | 2                          | 170 to 200°C | 1 min.                     |            |             |      |        |      |        |
| Step        | Temperature                  | Time                          |                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 1           | 100 to 120°C                 | 1 min.                        |                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 2           | 170 to 200°C                 | 1 min.                        |                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).<br>Perform the five cycles according to the four heat treatments shown in the following table.<br>Set for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                               |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. +0/−3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/−0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>                                                                                                                                                              | Step | 1           | 2    | 3 | 4            | Temp. (°C) | Min. Operating Temp. +0/−3 | Room Temp.   | Max. Operating Temp. +3/−0 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
| Step        | 1                            | 2                             | 3                                                                                                   | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
| Temp. (°C)  | Min. Operating Temp. +0/−3   | Room Temp.                    | Max. Operating Temp. +3/−0                                                                          | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
| Time (min.) | 30±3                         | 2 to 3                        | 30±3                                                                                                | 2 to 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |
|             |                              |                               |                                                                                                     | •Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours.<br>Perform the initial measurement.                                                                                                                                                                                                                                                                     |      |             |      |   |              |            |                            |              |                            |            |             |      |        |      |        |

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# GRM Series Specifications and Test Methods (1) (Note1) Typical Inspection

1

(Note1) This Specifications and Test Methods indicates typical inspection.

Please refer to individual specifications (our product specifications or the approval sheet).

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In case "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

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| No. | Item                    | Specifications                                                                                      |                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                          |
|-----|-------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         | Temperature Compensating Type                                                                       | High Dielectric Type                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                      |
| 16  | Humidity (Steady State) | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                        | Set the capacitor at 40±2°C and in 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                             |
|     |                         | Appearance                                                                                          | No defects or abnormalities                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                         | Capacitance Change                                                                                  | Within ±5% or ±0.5pF (Whichever is larger)                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                         | Q/D.F.                                                                                              | 30pF and over: $Q \geq 350$<br>10pF and over: $Q \geq 275 + 2.5C$<br>30pF and below: $Q \geq 200 + 10C$<br>C: Nominal Capacitance (pF) |                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                         | I.R.                                                                                                | More than 1,000MΩ or 50Ω · F (Whichever is smaller)                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                      |
| 17  | Humidity Load           | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                        | Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure.<br>The charge/discharge current is less than 50mA.<br>•Initial measurement for F1, F5/10V max.<br>Apply the rated DC voltage for 1 hour at 40±2°C.<br>Remove and set for 24±2 hours at room temperature.<br>Perform initial measurement. |
|     |                         | Appearance                                                                                          | No defects or abnormalities                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                         | Capacitance Change                                                                                  | Within ±7.5% or ±0.75pF (Whichever is larger)                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                         | Q/D.F.                                                                                              | 30pF and over: $Q \geq 200$<br>30pF and below: $Q \geq 100 + 10C/3$<br>C: Nominal Capacitance (pF)                                     |                                                                                                                                                                                                                                                                                                                                                                                      |
|     |                         | I.R.                                                                                                | More than 500MΩ or 25Ω · F (Whichever is smaller)                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                      |

Continued on the following page.

# GRM Series Specifications and Test Methods (1) (Note1) Typical Inspection

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In case "\*\*\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

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| No. | Item                  | Specifications                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----|-----------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                       | Temperature Compensating Type                                                                       | High Dielectric Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 18  | High Temperature Load | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>Apply 200%* of the rated voltage at the maximum operating temperature <math>\pm 3^{\circ}\text{C}</math> for 1000<math>\pm</math>12 hours.<br/>Set for 24<math>\pm</math>2 hours at room temperature, then measure.<br/>The charge/discharge current is less than 50mA.</p> <p>•Initial measurement for high dielectric constant type.<br/>Apply 200% of the rated voltage* at the maximum operating temperature <math>\pm 3^{\circ}\text{C}</math> for one hour. Remove and set for 24<math>\pm</math>2 hours at room temperature.<br/>Perform initial measurement.</p> <p>*GRM155C81E 683/104, GRM21BR71H105, GRM21BR72A474, GRM21BR71C225, GRM31CR71H475, GRM32E R6/R7 YA106, GRM32D R7/R6/C8 1E106: 150% of the rated voltage.</p> |
|     |                       | Appearance                                                                                          | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                       | Capacitance Change                                                                                  | <p>Within <math>\pm 3\%</math> or <math>\pm 0.3\text{pF}</math> (Whichever is larger)</p> <p>B1, B3, R1, R6, R7, C8 : Within <math>\pm 12.5\%</math><br/>F1, F5, E4: Within <math>\pm 30\%</math><br/>[Except 10V max. and. <math>C \geq 1.0\mu\text{F}</math>]<br/>F1, F5: Within <math>+30/-40\%</math><br/>[10V max. and <math>C \geq 1.0\mu\text{F}</math>]</p>                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                       | Q/D.F.                                                                                              | <p>[B1, B3, R6, R7, C8]<br/>W.V.: 100V<br/>: 0.05 max. (<math>C &lt; 0.068\mu\text{F}</math>)<br/>: 0.075 max. (<math>C \geq 0.068\mu\text{F}</math>)<br/>W.V.: 50/35/25/16/10V<br/>: 0.05 max.<br/>W.V.: 6.3/4V<br/>: 0.075 max. (<math>C &lt; 3.3\mu\text{F}</math>)<br/>: 0.125 max. (<math>C \geq 3.3\mu\text{F}</math>)</p> <p>[E4]<br/>W.V.: 25Vmin: 0.05 max.<br/>[F1, F5]<br/>W.V.: 25V min.<br/>: 0.075 max. (<math>C &lt; 0.1\mu\text{F}</math>)<br/>: 0.125 max. (<math>C \geq 0.1\mu\text{F}</math>)<br/>W.V.: 16/10V: 0.15 max.<br/>W.V.: 6.3V: 0.2 max.</p> <p>30pF and over: <math>Q \geq 350</math><br/>10pF and over<br/>30pF and below:<br/><math>Q \geq 275 + 2.5C</math><br/>10pF and below:<br/><math>Q \geq 200 + 10C</math></p> <p>C: Nominal Capacitance (pF)</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                       | I.R.                                                                                                | More than 1,000M $\Omega$ or 50 $\Omega \cdot \text{F}$ (Whichever is smaller)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

Table A-1

(1)

| Char. | Nominal Values (ppm/ $^{\circ}\text{C}$ )*1 | Capacitance Change from 25 $^{\circ}\text{C}$ (%) |       |      |       |      |       |
|-------|---------------------------------------------|---------------------------------------------------|-------|------|-------|------|-------|
|       |                                             | -55                                               |       | -30  |       | -10  |       |
|       |                                             | Max.                                              | Min.  | Max. | Min.  | Max. | Min.  |
| 5C    | 0 $\pm$ 30                                  | 0.58                                              | -0.24 | 0.40 | -0.17 | 0.25 | -0.11 |
| 6C    | 0 $\pm$ 60                                  | 0.87                                              | -0.48 | 0.59 | -0.33 | 0.38 | -0.21 |
| 6P    | -150 $\pm$ 60                               | 2.33                                              | 0.72  | 1.61 | 0.50  | 1.02 | 0.32  |
| 6R    | -220 $\pm$ 60                               | 3.02                                              | 1.28  | 2.08 | 0.88  | 1.32 | 0.56  |
| 6S    | -330 $\pm$ 60                               | 4.09                                              | 2.16  | 2.81 | 1.49  | 1.79 | 0.95  |
| 6T    | -470 $\pm$ 60                               | 5.46                                              | 3.28  | 3.75 | 2.26  | 2.39 | 1.44  |
| 7U    | -750 $\pm$ 120                              | 8.78                                              | 5.04  | 6.04 | 3.47  | 3.84 | 2.21  |
| 1X    | +350 to -1000                               | -                                                 | -     | -    | -     | -    | -     |

\*1: Nominal values denote the temperature coefficient within a range of 25 $^{\circ}\text{C}$  to 125 $^{\circ}\text{C}$  (for  $\Delta C$ )/85 $^{\circ}\text{C}$  (for other TC).

(2)

| Char. | Nominal Values (ppm/ $^{\circ}\text{C}$ )*2 | Capacitance Change from 20 $^{\circ}\text{C}$ (%) |       |      |       |      |       |
|-------|---------------------------------------------|---------------------------------------------------|-------|------|-------|------|-------|
|       |                                             | -55                                               |       | -25  |       | -10  |       |
|       |                                             | Max.                                              | Min.  | Max. | Min.  | Max. | Min.  |
| 2C    | 0 $\pm$ 60                                  | 0.82                                              | -0.45 | 0.49 | -0.27 | 0.33 | -0.18 |
| 3C    | 0 $\pm$ 120                                 | 1.37                                              | -0.90 | 0.82 | -0.54 | 0.55 | -0.36 |
| 4C    | 0 $\pm$ 250                                 | 2.56                                              | -1.88 | 1.54 | -1.13 | 1.02 | -0.75 |
| 2P    | -150 $\pm$ 60                               | -                                                 | -     | 1.32 | 0.41  | 0.88 | 0.27  |
| 3P    | -150 $\pm$ 120                              | -                                                 | -     | 1.65 | 0.14  | 1.10 | 0.09  |
| 4P    | -150 $\pm$ 250                              | -                                                 | -     | 2.36 | -0.45 | 1.57 | -0.30 |
| 2R    | -220 $\pm$ 60                               | -                                                 | -     | 1.70 | 0.72  | 1.13 | 0.48  |
| 3R    | -220 $\pm$ 120                              | -                                                 | -     | 2.03 | 0.45  | 1.35 | 0.30  |
| 4R    | -220 $\pm$ 250                              | -                                                 | -     | 2.74 | -0.14 | 1.83 | -0.09 |
| 2S    | -330 $\pm$ 60                               | -                                                 | -     | 2.30 | 1.22  | 1.54 | 0.81  |
| 3S    | -330 $\pm$ 120                              | -                                                 | -     | 2.63 | 0.95  | 1.76 | 0.63  |
| 4S    | -330 $\pm$ 250                              | -                                                 | -     | 3.35 | 0.36  | 2.23 | 0.24  |
| 2T    | -470 $\pm$ 60                               | -                                                 | -     | 3.07 | 1.85  | 2.05 | 1.23  |
| 3T    | -470 $\pm$ 120                              | -                                                 | -     | 3.40 | 1.58  | 2.27 | 1.05  |
| 4T    | -470 $\pm$ 250                              | -                                                 | -     | 4.12 | 0.99  | 2.74 | 0.66  |
| 3U    | -750 $\pm$ 120                              | -                                                 | -     | 4.94 | 2.84  | 3.29 | 1.89  |
| 4U    | -750 $\pm$ 250                              | -                                                 | -     | 5.65 | 2.25  | 3.77 | 1.50  |

\*2: Nominal values denote the temperature coefficient within a range of 20 $^{\circ}\text{C}$  to 125 $^{\circ}\text{C}$  (for  $\Delta C$ )/85 $^{\circ}\text{C}$  (for other TC).

## GRM Series Specifications and Test Methods (2) (Note1) Typical Inspection

(Note1) This Specifications and Test Methods indicates typical inspection.  
 Please refer to individual specifications (our product specifications or the approval sheet).  
 In case Non "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (1).  
 In case "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

| No.                  | Item                                                                                       |                                                                   | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
|----------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------|----------------------|--------|----------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----|-----------------------|--------------------------|-------|--------------------------------------|-----------------------|-------|-------------------------------------|-----|--------|-------|----|-----|--------|-------|-------|----------|--------|----|----|-----|--------|-------|-------|-----|--------|-------|----|-----|--------|-------|-------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|-------------------|--------------------|----------|-------------|--------------------|----------|-------------|--------|----------|-------------|----------------------|----------|-------------|
| 1                    | Operating Temperature Range                                                                |                                                                   | B1, B3, F1: -25 to +85°C<br>R1, R7, C7, D7, E7: -55 to +125°C<br>C6, R6: -55 to +85°C<br>F5: -30 to +85°C<br>C8, D8: -55 to +105°C,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Reference temperature: 25°C<br>(B1, B3, R1, F1: 20°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 2                    | Rated Voltage                                                                              |                                                                   | See the previous pages.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 3                    | Appearance                                                                                 |                                                                   | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 4                    | Dimensions                                                                                 |                                                                   | Within the specified dimensions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Using calipers (GRM02 size is based on Microscope)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 5                    | Dielectric Strength                                                                        |                                                                   | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 6                    | Insulation Resistance                                                                      |                                                                   | More than 50Ω · F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at reference temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 7                    | Capacitance                                                                                |                                                                   | Within the specified tolerance<br><br>*Table 1<br><table><tr><td>GRM155</td><td>B3/R6</td><td>1A</td><td>124 to 105</td></tr><tr><td>GRM185</td><td>B3/R6</td><td>1C/1A</td><td>105</td></tr><tr><td>GRM185</td><td>C8/D7</td><td>1A</td><td>105</td></tr><tr><td>GRM188</td><td>B3/R6</td><td>1C/1A</td><td>225</td></tr><tr><td>GRM188</td><td>R7/C8</td><td>1A</td><td>225</td></tr><tr><td>GRM188</td><td>B3/R6</td><td>1A</td><td>335</td></tr><tr><td>GRM219</td><td>B3/R6</td><td>1C/1A</td><td>475, 106</td></tr><tr><td>GRM219</td><td>C8</td><td>1A</td><td>475</td></tr><tr><td>GRM21B</td><td>B3/R6</td><td>1C/1A</td><td>106</td></tr><tr><td>GRM21B</td><td>R7/C8</td><td>1A</td><td>106</td></tr><tr><td>GRM319</td><td>B3/R6</td><td>1C/1A</td><td>106</td></tr></table> | GRM155                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | B3/R6 | 1A               | 124 to 105           | GRM185 | B3/R6                                                                      | 1C/1A   | 105                                                                                        | GRM185 | C8/D7                                                                      | 1A                                                                                        | 105 | GRM188                | B3/R6                    | 1C/1A | 225                                  | GRM188                | R7/C8 | 1A                                  | 225 | GRM188 | B3/R6 | 1A | 335 | GRM219 | B3/R6 | 1C/1A | 475, 106 | GRM219 | C8 | 1A | 475 | GRM21B | B3/R6 | 1C/1A | 106 | GRM21B | R7/C8 | 1A | 106 | GRM319 | B3/R6 | 1C/1A | 106 | <p>The capacitance/D.F. should be measured at reference temperature at the measuring frequency and voltage shown in the table.</p> <table><tr><th>Nominal Capacitance</th><th>Measuring Frequency</th><th>Measuring Voltage</th></tr><tr><td>C≤10μF (10V min.)*</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>C≤10μF (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>C&gt;10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr><tr><td>*For items in Table1</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr></table> | Nominal Capacitance | Measuring Frequency | Measuring Voltage | C≤10μF (10V min.)* | 1±0.1kHz | 1.0±0.2Vrms | C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | C>10μF | 120±24Hz | 0.5±0.1Vrms | *For items in Table1 | 1±0.1kHz | 0.5±0.1Vrms |
|                      | GRM155                                                                                     | B3/R6                                                             | 1A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 124 to 105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM185               | B3/R6                                                                                      | 1C/1A                                                             | 105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM185               | C8/D7                                                                                      | 1A                                                                | 105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM188               | B3/R6                                                                                      | 1C/1A                                                             | 225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM188               | R7/C8                                                                                      | 1A                                                                | 225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM188               | B3/R6                                                                                      | 1A                                                                | 335                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM219               | B3/R6                                                                                      | 1C/1A                                                             | 475, 106                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM219               | C8                                                                                         | 1A                                                                | 475                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM21B               | B3/R6                                                                                      | 1C/1A                                                             | 106                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM21B               | R7/C8                                                                                      | 1A                                                                | 106                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| GRM319               | B3/R6                                                                                      | 1C/1A                                                             | 106                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| Nominal Capacitance  | Measuring Frequency                                                                        | Measuring Voltage                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| C≤10μF (10V min.)*   | 1±0.1kHz                                                                                   | 1.0±0.2Vrms                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| C≤10μF (6.3V max.)   | 1±0.1kHz                                                                                   | 0.5±0.1Vrms                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| C>10μF               | 120±24Hz                                                                                   | 0.5±0.1Vrms                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| *For items in Table1 | 1±0.1kHz                                                                                   | 0.5±0.1Vrms                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 8                    | Dissipation Factor (D.F.)                                                                  |                                                                   | B1, B3, R1, R6*, R7*, C7, C8, E7, D7: 0.1 max.<br>C6: 0.125 max.<br>D8: 0.15 max.<br>F1, F5: 0.2 max.<br>*GRM31CR71E106: 0.125 max.<br>GRM31CR6 0J/0G 107: 0.15 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | GRM188C80E106:<br>Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 9                    | Capacitance Temperature Characteristics                                                    | No bias                                                           | B1, B3 : Within ±10% (-25 to +85°C)<br>F1 : Within +30/-80% (-25 to +85°C)<br>R6 : Within ±15% (-55 to +85°C)<br>R1, R7 : Within ±15% (-55 to +125°C)<br>F5 : Within +22/-82% (-30 to +85°C)<br>C6 : Within ±22% (-55 to +85°C)<br>C7 : Within ±22% (-55 to +125°C)<br>C8 : Within ±22% (-55 to +105°C)<br>D7 : Within +22/-33% (-55 to +125°C)<br>E7 : Within +22/-56% (-55 to +125°C)<br>D8 : Within +22/-33% (-55 to +105°C)                                                                                                                                                                                                                                                                                                                                                          | <p>The capacitance change should be measured after 5 min. at each specified temp. stage.<br/>The ranges of capacitance change compared with the reference temperature value over the temperature ranges shown in the table should be within the specified ranges.*<br/>In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.</p> <p>*GRM32DR60J226, GRM43 B1/B3/R6 0J/1A 336/476 only: 1.0±0.2Vrms</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr><tr><td rowspan="2">1</td><td>25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5)<br/>20±2 (for B1, B3, F1, R1)</td><td rowspan="3">No bias</td></tr><tr><td>-55±3 (for R1, R6, R7, C6, C7, C8, D7, D8, E7)<br/>-30±3 (for F5)<br/>-25±3 (for B1, B3, F1)</td></tr><tr><td rowspan="2">3</td><td>25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5)<br/>20±2 (for B1, B3, F1, R1)</td></tr><tr><td>125±3 (for R1, R7, C7, D7, E7)<br/>105±3 (for C8, D8)<br/>85±3 (for B1, B3, F1, F5, R6, C6)</td></tr><tr><td>5</td><td>20±2 (for B1, F1, R1)</td><td rowspan="4">50% of the rated voltage</td></tr><tr><td rowspan="2">6</td><td>-55±3 (for R1)<br/>-25±3 (for B1, F1)</td></tr><tr><td>20±2 (for B1, F1, R1)</td></tr><tr><td>8</td><td>125±3 (for R1)<br/>85±3 (for B1, F1)</td></tr></table> | Step  | Temperature (°C) | Applying Voltage (V) | 1      | 25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5)<br>20±2 (for B1, B3, F1, R1) | No bias | -55±3 (for R1, R6, R7, C6, C7, C8, D7, D8, E7)<br>-30±3 (for F5)<br>-25±3 (for B1, B3, F1) | 3      | 25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5)<br>20±2 (for B1, B3, F1, R1) | 125±3 (for R1, R7, C7, D7, E7)<br>105±3 (for C8, D8)<br>85±3 (for B1, B3, F1, F5, R6, C6) | 5   | 20±2 (for B1, F1, R1) | 50% of the rated voltage | 6     | -55±3 (for R1)<br>-25±3 (for B1, F1) | 20±2 (for B1, F1, R1) | 8     | 125±3 (for R1)<br>85±3 (for B1, F1) |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
|                      |                                                                                            | Step                                                              | Temperature (°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Applying Voltage (V)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 1                    | 25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5)<br>20±2 (for B1, B3, F1, R1)                 | No bias                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
|                      | -55±3 (for R1, R6, R7, C6, C7, C8, D7, D8, E7)<br>-30±3 (for F5)<br>-25±3 (for B1, B3, F1) |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 3                    | 25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5)<br>20±2 (for B1, B3, F1, R1)                 |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
|                      | 125±3 (for R1, R7, C7, D7, E7)<br>105±3 (for C8, D8)<br>85±3 (for B1, B3, F1, F5, R6, C6)  |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 5                    | 20±2 (for B1, F1, R1)                                                                      | 50% of the rated voltage                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 6                    | -55±3 (for R1)<br>-25±3 (for B1, F1)                                                       |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
|                      | 20±2 (for B1, F1, R1)                                                                      |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
| 8                    | 125±3 (for R1)<br>85±3 (for B1, F1)                                                        |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |
|                      | 50% of the Rated Voltage                                                                   | B1: Within +10/-30%<br>R1: Within +15/-40%<br>F1: Within +30/-95% | <p>•Initial measurement for high dielectric constant type<br/>Perform a heat treatment at 150 +0/-10°C for one hour and then set for 24±2 hours at room temperature.<br/>Perform the initial measurement.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                  |                      |        |                                                                            |         |                                                                                            |        |                                                                            |                                                                                           |     |                       |                          |       |                                      |                       |       |                                     |     |        |       |    |     |        |       |       |          |        |    |    |     |        |       |       |     |        |       |    |     |        |       |       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |                     |                   |                    |          |             |                    |          |             |        |          |             |                      |          |             |

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## GRM Series Specifications and Test Methods (2) (Note1) Typical Inspection

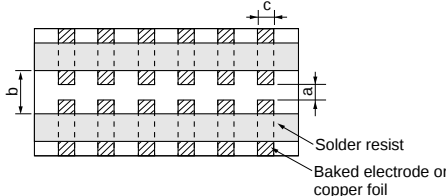
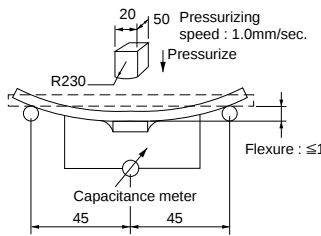
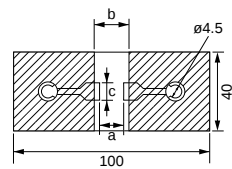
(Note1) This Specifications and Test Methods indicates typical inspection.

Please refer to individual specifications (our product specifications or the approval sheet).

In case Non "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (1).

In case "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

Continued from the preceding page.

| No.                | Item                                                                                                                                                                 | Specifications                                                                                                                                                                                                                                                                                                                                              | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------|-----|------|------|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|------|-------|-----|-----|------|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|
| 10                 | Adhesive Strength of Termination                                                                                                                                     | <p>No removal of the terminations or other defects should occur.</p>  <p>Fig. 1a</p>                                                                                                                                                                                       | <p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec.</p> <p>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p>*1N: GRM02, 2N: GRM03, 5N: GRM15/GRM18</p> <table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GRM02</td><td>0.2</td><td>0.56</td><td>0.23</td></tr><tr><td>GRM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GRM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table> | Type                        | a                  | b                              | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GRM02                                                                                                                                                                | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.56 | 0.23 | GRM03 | 0.3 | 0.9  | 0.3  | GRM15 | 0.4 | 1.5 | 0.5 | GRM18 | 1.0 | 3.0 | 1.2 | GRM21 | 1.2 | 4.0 | 1.65 | GRM31 | 2.2 | 5.0 | 2.0  | GRM32 | 2.2 | 5.0 | 2.9 | GRM43 | 3.5 | 7.0 | 3.7 | GRM55 | 4.5 | 8.0 | 5.6 |       |     |     |     |
| Type               | a                                                                                                                                                                    | b                                                                                                                                                                                                                                                                                                                                                           | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM02              | 0.2                                                                                                                                                                  | 0.56                                                                                                                                                                                                                                                                                                                                                        | 0.23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM03              | 0.3                                                                                                                                                                  | 0.9                                                                                                                                                                                                                                                                                                                                                         | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM15              | 0.4                                                                                                                                                                  | 1.5                                                                                                                                                                                                                                                                                                                                                         | 0.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM18              | 1.0                                                                                                                                                                  | 3.0                                                                                                                                                                                                                                                                                                                                                         | 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM21              | 1.2                                                                                                                                                                  | 4.0                                                                                                                                                                                                                                                                                                                                                         | 1.65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM31              | 2.2                                                                                                                                                                  | 5.0                                                                                                                                                                                                                                                                                                                                                         | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM32              | 2.2                                                                                                                                                                  | 5.0                                                                                                                                                                                                                                                                                                                                                         | 2.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM43              | 3.5                                                                                                                                                                  | 7.0                                                                                                                                                                                                                                                                                                                                                         | 3.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM55              | 4.5                                                                                                                                                                  | 8.0                                                                                                                                                                                                                                                                                                                                                         | 5.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| 11                 | Vibration                                                                                                                                                            | <table><tr><td>Appearance</td><td>No defects or abnormalities</td></tr><tr><td>Capacitance</td><td>Within the specified tolerance</td></tr><tr><td>D.F.</td><td>B1, B3, R1, R6*, R7*, C7, C8, E7, D7: 0.1 max.<br/>C6: 0.125 max.<br/>D8: 0.15 max.<br/>F1, F5: 0.2 max.<br/>*GRM31CR71E106: 0.125 max.<br/>GRM31CR6 0J/OG 107: 0.15 max.</td></tr></table> | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No defects or abnormalities | Capacitance        | Within the specified tolerance | D.F.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | B1, B3, R1, R6*, R7*, C7, C8, E7, D7: 0.1 max.<br>C6: 0.125 max.<br>D8: 0.15 max.<br>F1, F5: 0.2 max.<br>*GRM31CR71E106: 0.125 max.<br>GRM31CR6 0J/OG 107: 0.15 max. | <p>Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10).</p> <p>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</p> |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| Appearance         | No defects or abnormalities                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| Capacitance        | Within the specified tolerance                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| D.F.               | B1, B3, R1, R6*, R7*, C7, C8, E7, D7: 0.1 max.<br>C6: 0.125 max.<br>D8: 0.15 max.<br>F1, F5: 0.2 max.<br>*GRM31CR71E106: 0.125 max.<br>GRM31CR6 0J/OG 107: 0.15 max. |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| 12                 | Deflection                                                                                                                                                           | <table><tr><td>Appearance</td><td>No marking defects</td></tr><tr><td>Capacitance Change</td><td>Within ±10%</td></tr></table>  <p>Fig. 3a</p>                                                                                                                           | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No marking defects          | Capacitance Change | Within ±10%                    | <p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p>Fig. 2a</p> <table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GRM02</td><td>0.2</td><td>0.56</td><td>0.23</td></tr><tr><td>GRM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GRM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table> <p>(in mm)</p> | Type                                                                                                                                                                 | a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | b    | c    | GRM02 | 0.2 | 0.56 | 0.23 | GRM03 | 0.3 | 0.9 | 0.3 | GRM15 | 0.4 | 1.5 | 0.5 | GRM18 | 1.0 | 3.0 | 1.2  | GRM21 | 1.2 | 4.0 | 1.65 | GRM31 | 2.2 | 5.0 | 2.0 | GRM32 | 2.2 | 5.0 | 2.9 | GRM43 | 3.5 | 7.0 | 3.7 | GRM55 | 4.5 | 8.0 | 5.6 |
| Appearance         | No marking defects                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| Capacitance Change | Within ±10%                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| Type               | a                                                                                                                                                                    | b                                                                                                                                                                                                                                                                                                                                                           | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM02              | 0.2                                                                                                                                                                  | 0.56                                                                                                                                                                                                                                                                                                                                                        | 0.23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM03              | 0.3                                                                                                                                                                  | 0.9                                                                                                                                                                                                                                                                                                                                                         | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM15              | 0.4                                                                                                                                                                  | 1.5                                                                                                                                                                                                                                                                                                                                                         | 0.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM18              | 1.0                                                                                                                                                                  | 3.0                                                                                                                                                                                                                                                                                                                                                         | 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM21              | 1.2                                                                                                                                                                  | 4.0                                                                                                                                                                                                                                                                                                                                                         | 1.65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM31              | 2.2                                                                                                                                                                  | 5.0                                                                                                                                                                                                                                                                                                                                                         | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM32              | 2.2                                                                                                                                                                  | 5.0                                                                                                                                                                                                                                                                                                                                                         | 2.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM43              | 3.5                                                                                                                                                                  | 7.0                                                                                                                                                                                                                                                                                                                                                         | 3.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| GRM55              | 4.5                                                                                                                                                                  | 8.0                                                                                                                                                                                                                                                                                                                                                         | 5.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |
| 13                 | Solderability of Termination                                                                                                                                         | <p>75% of the terminations is to be soldered evenly and continuously.</p>                                                                                                                                                                                                                                                                                   | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds.</p> <p>After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |       |     |      |      |       |     |     |     |       |     |     |     |       |     |     |      |       |     |     |      |       |     |     |     |       |     |     |     |       |     |     |     |       |     |     |     |

Continued on the following page. ➤

## GRM Series Specifications and Test Methods (2) (Note1) Typical Inspection

(Note1) This Specifications and Test Methods indicates typical inspection.

Please refer to individual specifications (our product specifications or the approval sheet).

In case Non "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (1).

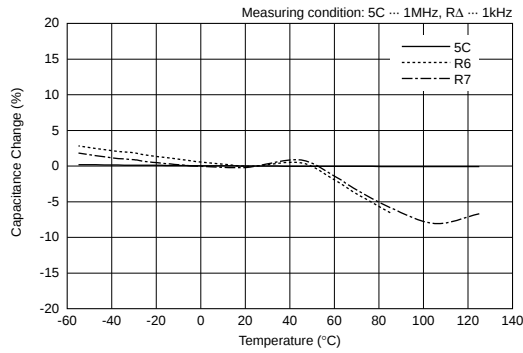
In case "\*" is added in PNs table, please refer to GRM Series Specifications and Test Methods (2).

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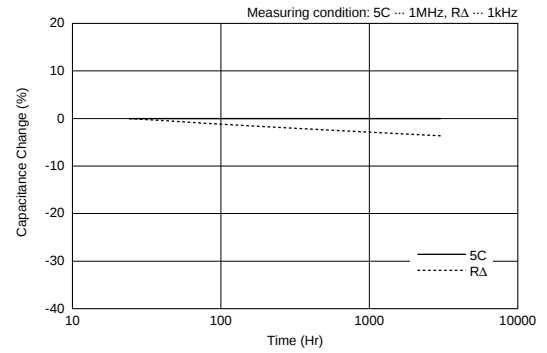
| No.                 | Item                                    |                    | Specifications                                                                                                                                                                      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|---------------------|-----------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------|------------|---|--------------|------------|----------------------------|--------------|----------------------------|------------|-------------|------|--------|------|--------|
| 14                  | Resistance to Soldering Heat            | Appearance         | No defects or abnormalities                                                                                                                                                         | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder* or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure. *Do not apply to GRM02.</p> <p>•Initial measurement for high dielectric constant type<br/>Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.</p> <p>*Preheating for GRM32/43/55</p> <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                                                      | Step       | Temperature                | Time       | 1 | 100 to 120°C | 1 min.     | 2                          | 170 to 200°C | 1 min.                     |            |             |      |        |      |        |
|                     |                                         | Step               | Temperature                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Time       |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | 1                  | 100 to 120°C                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1 min.     |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | 2                  | 170 to 200°C                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1 min.     |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | Capacitance Change | B1, B3, R1, R6*, R7, C6, C7, C8*, E7, D7, D8: Within ±7.5%<br>F1, F5: Within ±20%<br>*GRM188R6 0J/OG 106, GRM188C80E106, GRM219R60G226: within ±12.5%<br>GRM155R60G475: Within ±15% |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | D.F.               | B1, B3, R1, R6*, R7*, C7, C8, E7, D7: 0.1 max.<br>C6: 0.125 max.<br>D8: 0.15 max.<br>F1, F5: 0.2 max.<br>*GRM31CR71E106: 0.125 max.<br>GRM31CR6 0J/OG 107: 0.15 max.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| I.R.                | More than 50Ω · F                       |                    |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| Dielectric Strength | No defects                              |                    |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 15                  | Temperature Sudden Change               | Appearance         | No defects or abnormalities                                                                                                                                                         | <p>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table. Set for 24±2 hours at room temperature, then measure.</p> <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. +0/−3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/−0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table> <p>•Initial measurement for high dielectric constant type<br/>Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.<br/>GRM188R60J106 only Measurement after test<br/>Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.</p> | Step       | 1                          | 2          | 3 | 4            | Temp. (°C) | Min. Operating Temp. +0/−3 | Room Temp.   | Max. Operating Temp. +3/−0 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
|                     |                                         | Step               | 1                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2          | 3                          | 4          |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | Temp. (°C)         | Min. Operating Temp. +0/−3                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Room Temp. | Max. Operating Temp. +3/−0 | Room Temp. |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | Time (min.)        | 30±3                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2 to 3     | 30±3                       | 2 to 3     |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | Capacitance Change | B1, B3, R1, R6, R7, C6, C7, C8, D7, D8: Within ±7.5%<br>E7: Within ±30%<br>F1, F5: Within ±20%                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | D.F.               | B1, B3, R1, R6*, R7*, C7, C8, E7, D7: 0.1 max.<br>C6: 0.125 max.<br>D8: 0.15 max.<br>F1, F5: 0.2 max.<br>*GRM31CR71E106: 0.125 max.<br>GRM31CR6 0J/OG 107: 0.15 max.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| I.R.                | More than 50Ω · F                       |                    |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| Dielectric Strength | No defects                              |                    |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 16                  | High Temperature High Humidity (Steady) | Appearance         | No defects or abnormalities                                                                                                                                                         | <p>Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA.</p> <p>•Initial measurement<br/>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> <p>•Measurement after test<br/>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | Capacitance Change | B1, B3, R1, R6, R7, C6, C7, C8, E7, D7, D8: Within ±12.5%<br>F1, F5: Within ±30%                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | D.F.               | B1, B3, R1, R6, R7, C6, C7, C8, E7, D7, D8: 0.2 max.<br>F1, F5: 0.4 max.                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | I.R.               | More than 12.5Ω · F                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
| 17                  | Durability                              | Appearance         | No defects or abnormalities                                                                                                                                                         | <p>Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p> <p>•Initial measurement<br/>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> <p>•Measurement after test<br/>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</p>                                                                                                                                                                                                                                                                                                                                                                          |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | Capacitance Change | B1, B3, R1, R6*, R7, C6, C7, C8*, E7, D7, D8: Within ±12.5%<br>F1, F5: Within ±30%<br>*GRM188C80E106, GRM219R60G226: within ±15%                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | D.F.               | B1, B3, R1, R6, R7, C6, C7, C8, E7, D7, D8: 0.2 max.<br>F1, F5: 0.4 max.                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |
|                     |                                         | I.R.               | More than 25Ω · F                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                            |            |   |              |            |                            |              |                            |            |             |      |        |      |        |

## GRM Series Data

### ■ Capacitance - Temperature Characteristics

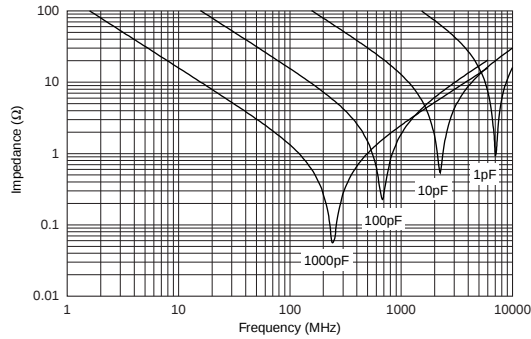


### ■ Capacitance Change - Aging

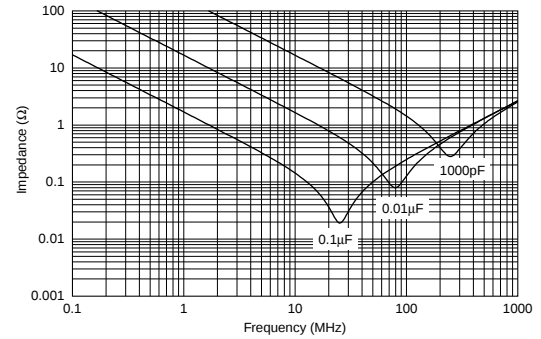


### ■ Impedance - Frequency Characteristics

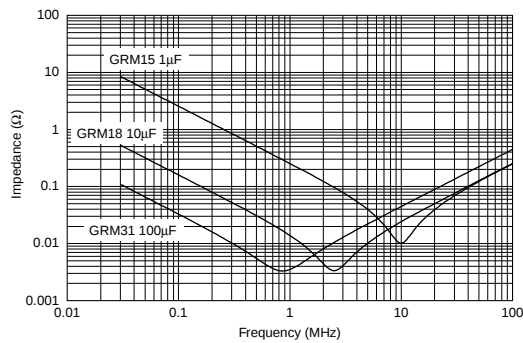
5C: GRM15



RΔ: GRM15



RΔ



The data herein are given in typical values, not guaranteed ratings.  
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 Our Web Site: [http://www.murata.com/products/capacitor/tech\\_data/index.html](http://www.murata.com/products/capacitor/tech_data/index.html)

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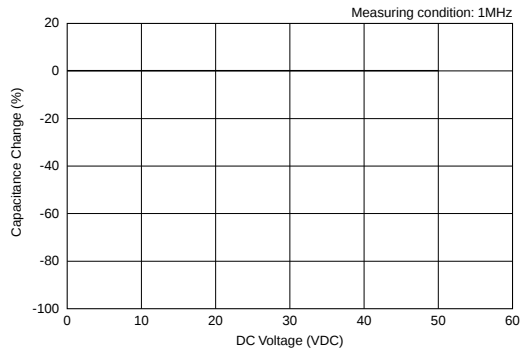
## GRM Series Data

1

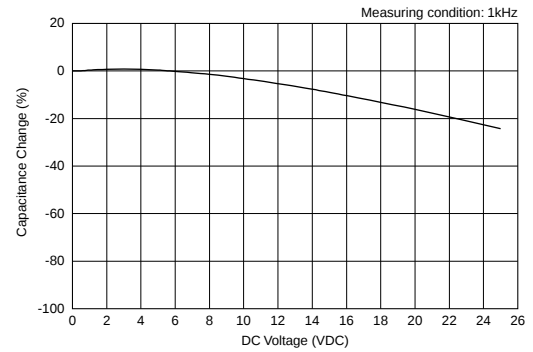
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### ■ Capacitance - DC Voltage Characteristics

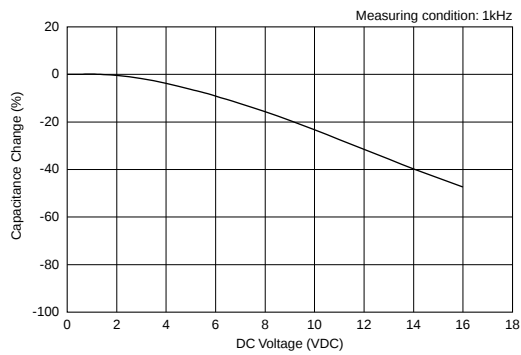
Temperature Compensating Type: GRM1555C1H102JA01



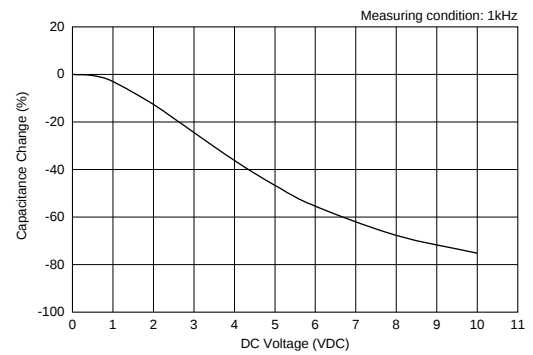
High Dielectric Constant Type: GRM155R71E103KA01



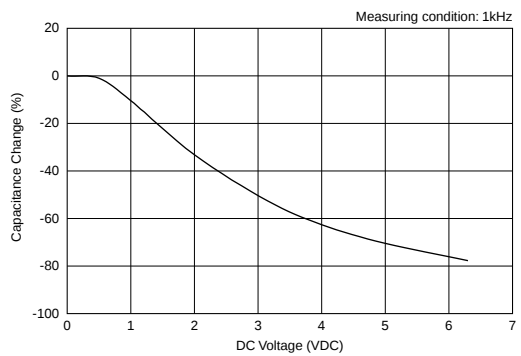
High Dielectric Constant Type: GRM155R71C104KA88



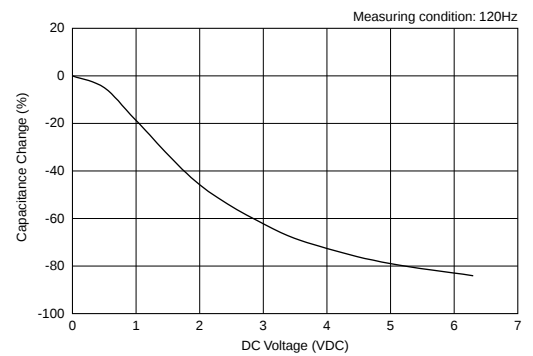
High Dielectric Constant Type: GRM155R61A105KE15



High Dielectric Constant Type: GRM188R60J106ME47



High Dielectric Constant Type: GRM31CR60J107ME39



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 Our Web Site: [http://www.murata.com/products/capacitor/tech\\_data/index.html](http://www.murata.com/products/capacitor/tech_data/index.html)

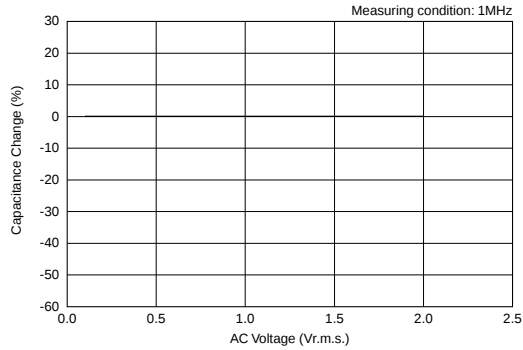
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## GRM Series Data

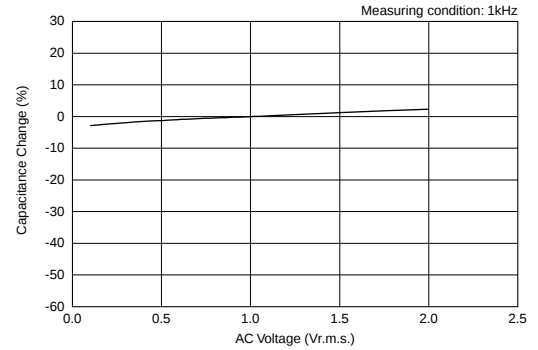
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### ■ Capacitance - AC Voltage Characteristics

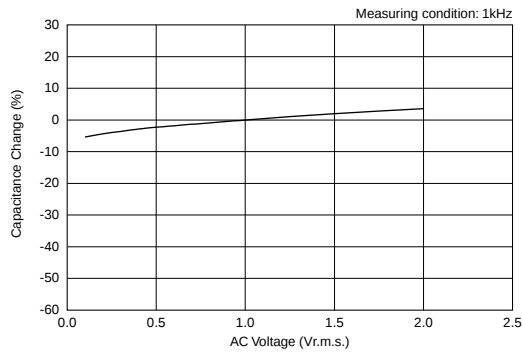
Temperature Compensating Type: GRM1555C1H102JA01



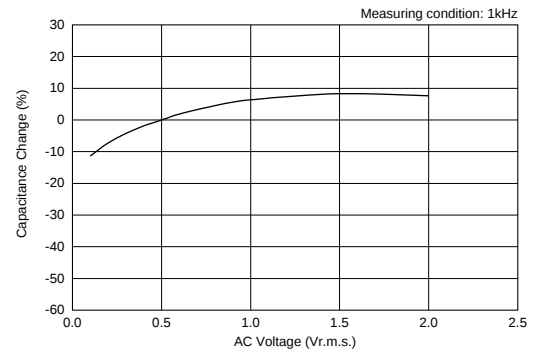
High Dielectric Constant Type: GRM155R71E103KA01



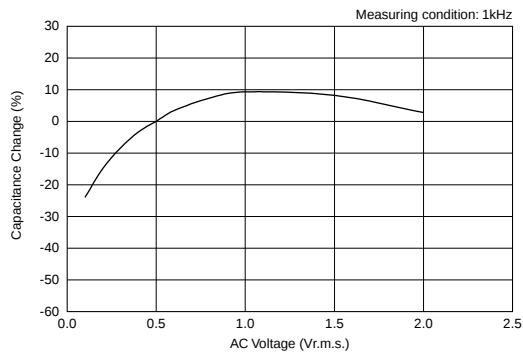
High Dielectric Constant Type: GRM155R71C104KA88



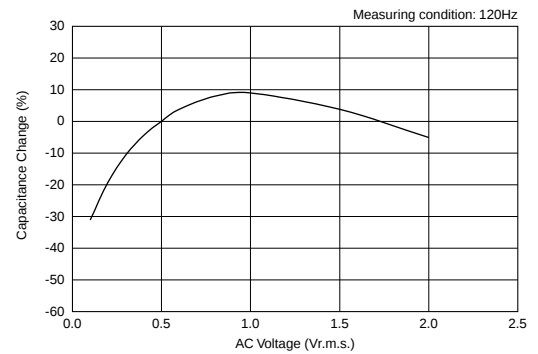
High Dielectric Constant Type: GRM155R61A105KE15



High Dielectric Constant Type: GRM188R60J106ME47



High Dielectric Constant Type: GRM31CR60J107ME39



The data herein are given in typical values, not guaranteed ratings.  
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 Our Web Site: [http://www.murata.com/products/capacitor/tech\\_data/index.html](http://www.murata.com/products/capacitor/tech_data/index.html)



## Capacitance Table

Continued from the preceding page.

### High Dielectric Constant Type X7R(R7)/X7S(C7) Characteristics

| 0.6          |                     | ex.0.6: T Dimension [mm]   |             |             |             |             |                            |             |             |                           |             |             |             |      |  |
|--------------|---------------------|----------------------------|-------------|-------------|-------------|-------------|----------------------------|-------------|-------------|---------------------------|-------------|-------------|-------------|------|--|
| Capacitance  | LxW [mm]            | 1.37x1.0<br>(1M)<br><0504> |             |             |             |             | 2.0x1.25<br>(21)<br><0805> |             |             | 3.2x1.6<br>(31)<br><1206> |             |             |             |      |  |
|              | Number of Elements  | 2(2)                       |             |             |             |             | 4(4)                       |             |             |                           |             |             |             |      |  |
|              | Rated Voltage [Vdc] | 50<br>(1H)                 | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  |             | 50<br>(1H)                 | 25<br>(1E)  | 16<br>(1C)  | 50<br>(1H)                | 25<br>(1E)  | 16<br>(1C)  | 6.3<br>(0J) |      |  |
|              | TC                  | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) |      |  |
| 470pF(471)   |                     |                            |             |             |             |             | 0.6                        |             |             |                           |             |             |             |      |  |
| 1000pF(102)  | 0.6                 |                            |             |             |             |             | 0.6                        |             |             |                           |             |             |             |      |  |
| 2200pF(222)  |                     |                            | 0.6         |             |             |             |                            | 0.6         |             |                           |             |             |             |      |  |
| 4700pF(472)  |                     |                            | 0.6         |             |             |             |                            | 0.6         |             |                           |             |             |             |      |  |
| 10000pF(103) |                     |                            | 0.6         |             |             |             |                            | 0.6         |             |                           |             |             |             |      |  |
| 22000pF(223) |                     |                            |             | 0.6         | 0.6         |             |                            |             | 0.85        |                           |             |             |             |      |  |
| 47000pF(473) |                     |                            |             | 0.6         | 0.6         |             |                            |             | 0.85        | 0.85                      |             |             | 1.0         |      |  |
| 0.10μF(104)  |                     |                            |             | 0.6         |             | 0.6         |                            |             | 0.85        | 0.85                      | 0.85        |             | 1.0         |      |  |
| 1.0μF(105)   |                     |                            |             |             |             |             |                            |             |             |                           |             |             |             | 1.15 |  |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

### High Dielectric Constant Type X5R(R6) Characteristics

| 0.6          |                     | ex.0.6: T Dimension [mm]  |             |             |             |                            |             |             |             |             |                            |             |             |                            |             |                           |             |
|--------------|---------------------|---------------------------|-------------|-------------|-------------|----------------------------|-------------|-------------|-------------|-------------|----------------------------|-------------|-------------|----------------------------|-------------|---------------------------|-------------|
| Capacitance  | LxW [mm]            | 0.9x0.6<br>(0M)<br><0302> |             |             |             | 1.37x1.0<br>(1M)<br><0504> |             |             |             |             | 2.0x1.25<br>(21)<br><0805> |             |             | 2.0x1.25<br>(21)<br><0805> |             | 3.2x1.6<br>(31)<br><1206> |             |
|              | Number of Elements  |                           |             |             |             | 2(2)                       |             |             |             |             |                            |             |             | 4(4)                       |             |                           |             |
|              | Rated Voltage [Vdc] | 16<br>(1C)                | 10<br>(1A)  | 6.3<br>(0J) | 4<br>(0G)   | 50<br>(1H)                 | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  | 6.3<br>(0J) | 16<br>(1C)                 | 10<br>(1A)  | 6.3<br>(0J) | 10<br>(1A)                 | 6.3<br>(0J) | 16<br>(1C)                | 10<br>(1A)  |
|              | TC                  | X5R<br>(R6)               | X5R<br>(R6) | X5R<br>(R6) | X5R<br>(R6) | X5R<br>(R6)                | X5R<br>(R6) | X5R<br>(R6) | X5R<br>(R6) | X5R<br>(R6) | X5R<br>(R6)                | X5R<br>(R6) | X5R<br>(R6) | X5R<br>(R6)                | X5R<br>(R6) | X5R<br>(R6)               | X5R<br>(R6) |
| 1000pF(102)  |                     |                           |             |             |             | 0.6                        |             |             |             |             |                            |             |             |                            |             |                           |             |
| 2200pF(222)  |                     |                           |             |             |             |                            | 0.6         |             |             |             |                            |             |             |                            |             |                           |             |
| 4700pF(472)  |                     |                           |             |             |             |                            | 0.6         |             |             |             |                            |             |             |                            |             |                           |             |
| 10000pF(103) | 0.45                | 0.45                      | 0.45        |             |             |                            | 0.6         |             |             |             |                            |             |             |                            |             |                           |             |
| 22000pF(223) | 0.45                | 0.45                      | 0.45        |             |             |                            |             | 0.6         | 0.6         |             |                            |             |             |                            |             |                           |             |
| 47000pF(473) | 0.45                | 0.45                      | 0.45        |             |             |                            |             | 0.6         | 0.6         |             |                            |             |             |                            |             |                           |             |
| 0.10μF(104)  | 0.45                | 0.45                      | 0.45        |             |             |                            |             |             | 0.6         |             |                            |             |             |                            |             |                           |             |
| 0.22μF(224)  |                     |                           |             |             |             |                            |             | 0.8         |             |             |                            |             |             |                            |             |                           |             |
| 0.47μF(474)  |                     |                           |             |             |             |                            |             |             |             |             | 0.85                       |             |             |                            |             |                           |             |
| 1.0μF(105)   |                     |                           |             |             | 0.45        |                            |             | 0.8         | 0.8         | 0.8         | 0.85                       | 0.85        |             | 0.85                       | 0.85        | 0.85                      | 0.85        |
| 2.2μF(225)   |                     |                           |             |             |             |                            |             | 0.8         | 0.8         |             | 0.85                       | 0.85        |             | 0.85                       |             |                           |             |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

### High Dielectric Constant Type X7R(R7) Characteristics Low Profile

| 0.5         |                     | ex.0.5: T Dimension [mm]   |                            |
|-------------|---------------------|----------------------------|----------------------------|
| Capacitance | LxW [mm]            | 1.37x1.0<br>(1M)<br><0504> | 2.0x1.25<br>(21)<br><0805> |
|             | Number of Elements  | 2(2)                       | 4(4)                       |
|             | Rated Voltage [Vdc] | 16<br>(1C)                 | 16<br>(1C)                 |
|             | TC                  | X7R<br>(R7)                | X7R<br>(R7)                |
| 0.10μF(104) |                     | 0.5                        | 0.5                        |

The part number code is shown in ( ) and Unit is shown in [ ].  
< >: EIA [inch] Code

### High Dielectric Constant Type X5R(R6) Characteristics Low Profile

| 0.5         |                     | ex.0.5: T Dimension [mm]   |                            |             |
|-------------|---------------------|----------------------------|----------------------------|-------------|
| Capacitance | LxW [mm]            | 1.37x1.0<br>(1M)<br><0504> | 2.0x1.25<br>(21)<br><0805> |             |
|             | Number of Elements  | 2(2)                       | 4(4)                       |             |
|             | Rated Voltage [Vdc] | 16<br>(1C)                 | 10<br>(1A)                 | 16<br>(1C)  |
|             | TC                  | X5R<br>(R6)                | X5R<br>(R6)                | X5R<br>(R6) |
| 1.0μF(105)  |                     | 0.5                        | 0.5                        | 0.5         |

The part number code is shown in ( ) and Unit is shown in [ ].  
< >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 1.37x1.0(1M)<0504> | 2.0x1.25(21)<0805> | 3.2x1.6(31)<1206>  |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 50(1H)             | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10pF(100)         | ±10%(K)   | GNM1M25C1H100KD01D | GNM2145C1H100KD01D | GNM3145C2A100KD01D | GNM3145C1H100KD01D |
| 15pF(150)         | ±10%(K)   | GNM1M25C1H150KD01D | GNM2145C1H150KD01D | GNM3145C2A150KD01D | GNM3145C1H150KD01D |
| 22pF(220)         | ±10%(K)   | GNM1M25C1H220KD01D | GNM2145C1H220KD01D | GNM3145C2A220KD01D | GNM3145C1H220KD01D |
| 33pF(330)         | ±10%(K)   | GNM1M25C1H330KD01D | GNM2145C1H330KD01D | GNM3145C2A330KD01D | GNM3145C1H330KD01D |
| 47pF(470)         | ±10%(K)   | GNM1M25C1H470KD01D | GNM2145C1H470KD01D | GNM3145C2A470KD01D | GNM3145C1H470KD01D |
| 68pF(680)         | ±10%(K)   | GNM1M25C1H680KD01D | GNM2145C1H680KD01D | GNM3145C2A680KD01D | GNM3145C1H680KD01D |
| 100pF(101)        | ±10%(K)   | GNM1M25C1H101KD01D | GNM2145C1H101KD01D | GNM3145C2A101KD01D | GNM3145C1H101KD01D |
| 150pF(151)        | ±10%(K)   | GNM1M25C1H151KD01D | GNM2145C1H151KD01D | GNM3145C2A151KD01D | GNM3145C1H151KD01D |
| 220pF(221)        | ±10%(K)   | GNM1M25C1H221KD01D | GNM2145C1H221KD01D |                    | GNM3145C1H221KD01D |
| 330pF(331)        | ±10%(K)   |                    |                    |                    | GNM3145C1H331KD01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## High Dielectric Constant Type X7R(R7)/X7S(C7) Characteristics

| LxW [mm]           |           | 1.37x1.0(1M)<0504> |                    |                    |                    |
|--------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Number of Elements |           | 2(2)               |                    |                    |                    |
| Rated Volt. [Vdc]  |           | 50(1H)             | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance        | Tolerance | Part Number        |                    |                    |                    |
| 1000pF(102)        | ±20%(M)   | GNM1M2R71H102MA01D |                    |                    |                    |
| 2200pF(222)        | ±20%(M)   |                    | GNM1M2R71E222MA01D |                    |                    |
| 4700pF(472)        | ±20%(M)   |                    | GNM1M2R71E472MA01D |                    |                    |
| 10000pF(103)       | ±20%(M)   |                    | GNM1M2R71E103MA01D |                    |                    |
| 22000pF(223)       | ±20%(M)   |                    |                    | GNM1M2R71C223MA01D | GNM1M2R71A223MA01D |
| 47000pF(473)       | ±20%(M)   |                    |                    | GNM1M2R71C473MA01D | GNM1M2R71A473MA01D |
| 0.10μF(104)        | ±20%(M)   |                    |                    | GNM1M2R71C104MA01D | GNM1M2C71A104MA01D |

| LxW [mm]           |           | 2.0x1.25(21)<0805> |                    |                    |  |
|--------------------|-----------|--------------------|--------------------|--------------------|--|
| Number of Elements |           | 4(4)               |                    |                    |  |
| Rated Volt. [Vdc]  |           | 50(1H)             | 25(1E)             | 16(1C)             |  |
| Capacitance        | Tolerance | Part Number        |                    |                    |  |
| 470pF(471)         | ±20%(M)   | GNM214R71H471MA01D |                    |                    |  |
| 1000pF(102)        | ±20%(M)   | GNM214R71H102MA01D |                    |                    |  |
| 2200pF(222)        | ±20%(M)   |                    | GNM214R71E222MA01D |                    |  |
| 4700pF(472)        | ±20%(M)   |                    | GNM214R71E472MA01D |                    |  |
| 10000pF(103)       | ±20%(M)   |                    | GNM214R71E103MA01D |                    |  |
| 22000pF(223)       | ±20%(M)   |                    |                    | GNM214R71C223MA01D |  |
| 47000pF(473)       | ±20%(M)   |                    |                    | GNM214R71C473MA01D |  |
| 0.10μF(104)        | ±20%(M)   |                    |                    | GNM214R71C104MA01D |  |

| LxW [mm]           |           | 3.2x1.6(31)<1206>  |                    |                    |                    |
|--------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Number of Elements |           | 4(4)               |                    |                    |                    |
| Rated Volt. [Vdc]  |           | 50(1H)             | 25(1E)             | 16(1C)             | 6.3(0J)            |
| Capacitance        | Tolerance | Part Number        |                    |                    |                    |
| 47000pF(473)       | ±20%(M)   | GNM314R71H473MA11D |                    | GNM314R71C473MA01L |                    |
| 0.10μF(104)        | ±20%(M)   | GNM314R71H104MA11D | GNM314R71E104MA11D | GNM314R71C104MA01L |                    |
| 1.0μF(105)         | ±20%(M)   |                    |                    |                    | GNM314R70J105MA01L |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

\*: Please refer to GNM series Specifications and Test Method(2).

(Part Number) **GN** **M** **1M** **2** **5C** **1H** **100** **K** **D01** **D** ①Product ID ②Series ③Dimension (LxW) ④Number of Elements  
⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## High Dielectric Constant Type X5R(R6) Characteristics

2

| LxW [mm]           |           | 0.9x0.6(0M)<0302>   |                     |                     |                     |
|--------------------|-----------|---------------------|---------------------|---------------------|---------------------|
| Number of Elements |           | 2(2)                |                     |                     |                     |
| Rated Volt. [Vdc]  |           | 16(1C)              | 10(1A)              | 6.3(0J)             | 4(0G)               |
| Capacitance        | Tolerance | Part Number         |                     |                     |                     |
| 10000pF(103)       | ±20%(M)   | GNM0M2R61C103ME18D* | GNM0M2R61A103ME17D* | GNM0M2R60J103ME17D* |                     |
| 22000pF(223)       | ±20%(M)   | GNM0M2R61C223ME18D* | GNM0M2R61A223ME17D* | GNM0M2R60J223ME17D* |                     |
| 47000pF(473)       | ±20%(M)   | GNM0M2R61C473ME18D* | GNM0M2R61A473ME17D* | GNM0M2R60J473ME17D* |                     |
| 0.10μF(104)        | ±20%(M)   | GNM0M2R61C104ME18D* | GNM0M2R61A104ME17D* | GNM0M2R60J104ME17D* |                     |
| 1.0μF(105)         | ±20%(M)   |                     |                     |                     | GNM0M2R60G105ME17D* |

| LxW [mm]           |           | 1.37x1.0(1M)<0504> |                    |                     |
|--------------------|-----------|--------------------|--------------------|---------------------|
| Number of Elements |           | 2(2)               |                    |                     |
| Rated Volt. [Vdc]  |           | 50(1H)             | 25(1E)             | 16(1C)              |
| Capacitance        | Tolerance | Part Number        |                    |                     |
| 1000pF(102)        | ±20%(M)   | GNM1M2R61H102MA01D |                    |                     |
| 2200pF(222)        | ±20%(M)   |                    | GNM1M2R61E222MA01D |                     |
| 4700pF(472)        | ±20%(M)   |                    | GNM1M2R61E472MA01D |                     |
| 10000pF(103)       | ±20%(M)   |                    | GNM1M2R61E103MA01D |                     |
| 22000pF(223)       | ±20%(M)   |                    |                    | GNM1M2R61C223MA01D  |
| 47000pF(473)       | ±20%(M)   |                    |                    | GNM1M2R61C473MA01D  |
| 0.22μF(224)        | ±20%(M)   |                    |                    | GNM1M2R61C224ME18D* |
| 1.0μF(105)         | ±20%(M)   |                    |                    | GNM1M2R61C105ME18D* |

| LxW [mm]           |           | 1.37x1.0(1M)<0504>  |                     |
|--------------------|-----------|---------------------|---------------------|
| Number of Elements |           | 2(2)                |                     |
| Rated Volt. [Vdc]  |           | 10(1A)              | 6.3(0J)             |
| Capacitance        | Tolerance | Part Number         |                     |
| 22000pF(223)       | ±20%(M)   | GNM1M2R61A223MA01D  |                     |
| 47000pF(473)       | ±20%(M)   | GNM1M2R61A473MA01D  |                     |
| 0.10μF(104)        | ±20%(M)   | GNM1M2R61A104MA01D  |                     |
| 1.0μF(105)         | ±20%(M)   | GNM1M2R61A105ME17D* | GNM1M2R60J105ME12D* |
| 2.2μF(225)         | ±20%(M)   | GNM1M2R61A225ME18D* | GNM1M2R60J225ME18D* |

| LxW [mm]           |           | 2.0x1.25(21)<0805> |                     |                     |
|--------------------|-----------|--------------------|---------------------|---------------------|
| Number of Elements |           | 2(2)               |                     |                     |
| Rated Volt. [Vdc]  |           | 16(1C)             | 10(1A)              | 6.3(0J)             |
| Capacitance        | Tolerance | Part Number        |                     |                     |
| 0.47μF(474)        | ±20%(M)   | GNM212R61C474MA16D |                     |                     |
| 1.0μF(105)         | ±20%(M)   | GNM212R61C105MA16D | GNM212R61A105MA13D  |                     |
| 2.2μF(225)         | ±20%(M)   |                    | GNM212R61A225ME16D* | GNM212R60J225ME16D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GNM series Specifications and Test Method(2).

(Part Number) GN M 0M 2 R6 1C 103 M E18 D  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

①Product ID ②Series  
 ⑤Temperature Characteristics  
 ⑧Capacitance Tolerance

③Dimension (LxW) ④Number of Elements  
 ⑥Rated Voltage ⑦Capacitance  
 ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD Tray.

## High Dielectric Constant Type X5R(R6) Characteristics

|                    |           |                     |                     |
|--------------------|-----------|---------------------|---------------------|
| LxW [mm]           |           | 2.0x1.25(21)<0805>  |                     |
| Number of Elements |           | 4(4)                |                     |
| Rated Volt. [Vdc]  |           | 10(1A)              | 6.3(0J)             |
| Capacitance        | Tolerance | Part Number         |                     |
| 1.0μF(105)         | ±20%(M)   | GNM214R61A105ME17D* | GNM214R60J105ME17D* |
| 2.2μF(225)         | ±20%(M)   |                     | GNM214R60J225ME18D* |

|                    |           |                    |                    |
|--------------------|-----------|--------------------|--------------------|
| LxW [mm]           |           | 3.2x1.6(31)<1206>  |                    |
| Number of Elements |           | 4(4)               |                    |
| Rated Volt. [Vdc]  |           | 16(1C)             | 10(1A)             |
| Capacitance        | Tolerance | Part Number        |                    |
| 1.0μF(105)         | ±20%(M)   | GNM314R61C105MA15D | GNM314R61A105MA13D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GNM series Specifications and Test Method(2).

## High Dielectric Constant Type X7R(R7) Characteristics Low Profile

|                    |           |                    |                    |
|--------------------|-----------|--------------------|--------------------|
| LxW [mm]           |           | 1.37x1.0(1M)<0504> | 2.0x1.25(21)<0805> |
| Number of Elements |           | 2(2)               | 4(4)               |
| Rated Volt. [Vdc]  |           | 16(1C)             | 16(1C)             |
| Capacitance        | Tolerance | Part Number        |                    |
| 0.10μF(104)        | ±20%(M)   | GNM1M2R71C104MAA1D | GNM214R71C104MAA1D |

## High Dielectric Constant Type X5R(R6) Characteristics Low Profile

|                    |           |                     |                     |
|--------------------|-----------|---------------------|---------------------|
| LxW [mm]           |           | 1.37x1.0(1M)<0504>  |                     |
| Number of Elements |           | 2(2)                |                     |
| Rated Volt. [Vdc]  |           | 16(1C)              | 10(1A)              |
| Capacitance        | Tolerance | Part Number         |                     |
| 1.0μF(105)         | ±20%(M)   | GNM1M2R61C105MEA2D* | GNM1M2R61A105MEA4D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GNM series Specifications and Test Method(2).

## GNM Series Specifications and Test Methods (1)

In case Non "\*\*\*" is added in PNs table, please refer to GNM Series Specifications and Test Methods (1).  
In case "\*\*\*" is added in PNs table, please refer to GNM Series Specifications and Test Methods (2).

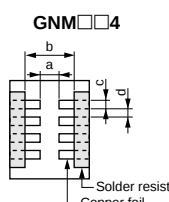
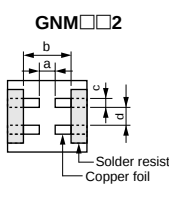
| No.                     | Item                                           | Specifications                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
|-------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|-------------|-----|-----------------|------------|-------------|------------|----------------|-------------|--------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|--------|------|-----|--------------------------------------|------|--------|-----|-------------------------------------|-----|------|
|                         |                                                | Temperature Compensating Type                                                                                                                                                                                                                                        | High Dielectric Type                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 1                       | Operating Temperature Range                    | 5C: -55 to +125°C                                                                                                                                                                                                                                                    | R7, C7: -55 to +125°C<br>R6: -55 to +85°C                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 2                       | Rated Voltage                                  | See the previous pages.                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                        | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 3                       | Appearance                                     | No defects or abnormalities                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                        | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 4                       | Dimensions                                     | Within the specified dimensions                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 5                       | Dielectric Strength                            | No defects or abnormalities                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                        | No failure should be observed when 300% of the rated voltage (5C) or 250% of the rated voltage (R7) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 6                       | Insulation Resistance                          | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                        | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 7                       | Capacitance                                    | Within the specified tolerance                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                        | The capacitance/Q/D.F. should be measured at 25°C at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 8                       | Q/ Dissipation Factor (D.F.)                   | 30pF min.: $Q \geq 1000$<br>30pF max.: $Q \geq 400+20C$<br><br>C: Nominal Capacitance (pF)                                                                                                                                                                           | <table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>R7, R6, C7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td><td>0.05 max.</td></tr></table>                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Char.       | 25V min.        | 16V         | 10V | 6.3V            | R7, R6, C7 | 0.025 max.  | 0.035 max. | 0.035 max.     | 0.05 max.   |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| Char.                   | 25V min.                                       | 16V                                                                                                                                                                                                                                                                  | 10V                                                                                                                                                                                                                                                                                                                    | 6.3V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| R7, R6, C7              | 0.025 max.                                     | 0.035 max.                                                                                                                                                                                                                                                           | 0.035 max.                                                                                                                                                                                                                                                                                                             | 0.05 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 9                       | Capacitance Temperature Characteristics        | Capacitance Change                                                                                                                                                                                                                                                   | <table><tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change</th></tr><tr><td>R7</td><td>-55°C to +125°C</td><td rowspan="3">25°C</td><td>Within ±15%</td></tr><tr><td>R6</td><td>-55°C to +85°C</td><td rowspan="2">Within ±22%</td></tr><tr><td>C7</td><td>-55°C to +125°C</td></tr></table> | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Temp. Range | Reference Temp. | Cap. Change | R7  | -55°C to +125°C | 25°C       | Within ±15% | R6         | -55°C to +85°C | Within ±22% | C7     | -55°C to +125°C | <div>The capacitance change should be measured after 5 min. at each specified temperature stage.</div> <div>(1) Temperature Compensating Type</div> <div>The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.</div> <div>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the steps 1, 3 and 5 by the cap. value in step 3.</div> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>-55±3 (for 5C/R7/C7), -30±3 (for F5)</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3 (for 5C/R7/C7), 85±3 (for F5)</td></tr><tr><td>5</td><td>25±2</td></tr></table> <div>(2) High Dielectric Constant Type</div> <div>The ranges of capacitance change compared with the above 25°C value over the temperature ranges shown in the table should be within the specified ranges.</div> <div>• Initial measurement for high dielectric constant type.</div> <div>Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature.</div> <div>Perform the initial measurement.</div> | Step | Temperature (°C) | 1      | 25±2 | 2   | -55±3 (for 5C/R7/C7), -30±3 (for F5) | 3    | 25±2   | 4   | 125±3 (for 5C/R7/C7), 85±3 (for F5) | 5   | 25±2 |
|                         |                                                | Char.                                                                                                                                                                                                                                                                | Temp. Range                                                                                                                                                                                                                                                                                                            | Reference Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Cap. Change |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
|                         |                                                | R7                                                                                                                                                                                                                                                                   | -55°C to +125°C                                                                                                                                                                                                                                                                                                        | 25°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Within ±15% |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
|                         |                                                | R6                                                                                                                                                                                                                                                                   | -55°C to +85°C                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Within ±22% |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| C7                      | -55°C to +125°C                                |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| Step                    | Temperature (°C)                               |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 1                       | 25±2                                           |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 2                       | -55±3 (for 5C/R7/C7), -30±3 (for F5)           |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 3                       | 25±2                                           |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 4                       | 125±3 (for 5C/R7/C7), 85±3 (for F5)            |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 5                       | 25±2                                           |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| Temperature Coefficient | Within the specified tolerance (Table A)       |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| Capacitance Drift       | Within ±0.2% or ±0.05pF (Whichever is larger.) |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
|                         |                                                |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| 10                      | Adhesive Strength of Termination               | No removal of the terminations or other defect should occur. <div><div></div><div></div></div> |                                                                                                                                                                                                                                                                                                                        | <div>Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 5N force in parallel with the test jig for 10±1 sec.</div> <div>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</div> <table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M2</td><td>0.5</td><td>1.6</td><td>0.32</td><td>0.32</td></tr><tr><td>GNM212</td><td>0.6</td><td>1.8</td><td>0.5</td><td>0.5</td></tr><tr><td>GNM214</td><td>0.6</td><td>2.0</td><td>0.25</td><td>0.25</td></tr><tr><td>GNM314</td><td>0.8</td><td>2.5</td><td>0.4</td><td>0.4</td></tr></table> <div>(in mm)</div> | Type        | a               | b           | c   | d               | GNM1M2     | 0.5         | 1.6        | 0.32           | 0.32        | GNM212 | 0.6             | 1.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.5  | 0.5              | GNM214 | 0.6  | 2.0 | 0.25                                 | 0.25 | GNM314 | 0.8 | 2.5                                 | 0.4 | 0.4  |
| Type                    | a                                              | b                                                                                                                                                                                                                                                                    | c                                                                                                                                                                                                                                                                                                                      | d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| GNM1M2                  | 0.5                                            | 1.6                                                                                                                                                                                                                                                                  | 0.32                                                                                                                                                                                                                                                                                                                   | 0.32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| GNM212                  | 0.6                                            | 1.8                                                                                                                                                                                                                                                                  | 0.5                                                                                                                                                                                                                                                                                                                    | 0.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| GNM214                  | 0.6                                            | 2.0                                                                                                                                                                                                                                                                  | 0.25                                                                                                                                                                                                                                                                                                                   | 0.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |
| GNM314                  | 0.8                                            | 2.5                                                                                                                                                                                                                                                                  | 0.4                                                                                                                                                                                                                                                                                                                    | 0.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                 |             |     |                 |            |             |            |                |             |        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                  |        |      |     |                                      |      |        |     |                                     |     |      |

Fig. 1

Fig. 1

Continued on the following page. 

## GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

In case Non "" is added in PNs table, please refer to GNM Series Specifications and Test Methods (1).  
 In case "" is added in PNs table, please refer to GNM Series Specifications and Test Methods (2).

| No.    | Item                         | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                            | Test Method |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|--------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---|---|--------|----------|----------|-----------|-----------|--------|----------|----------|----------|----------|--------|----------|----------|----------|----------|--------|----------|----------|
|        |                              | Temperature Compensating Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | High Dielectric Type                                                                       |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| 11     | Vibration Resistance         | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No defects or abnormalities                                                                |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        |                              | Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Within the specified tolerance                                                             |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        |                              | Q/D.F.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30pF min.: $Q \geq 1000$<br>30pF max.: $Q \geq 400+20C$<br><br>C: Nominal Capacitance (pF) | Char.       | 25V min.                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 16V  | 10V  | 6.3V |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| 12     | Deflection                   | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No marking defects                                                                         |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3 for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within ±5% or ±0.5pF (Whichever is larger)                                                 | Within ±10% |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        |                              | <div><div><p>•GNM□□4</p><table><thead><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr></thead><tbody><tr><td>GNM1M2</td><td>2.0±0.05</td><td>0.5±0.05</td><td>0.32±0.05</td><td>0.32±0.05</td></tr><tr><td>GNM212</td><td>2.0±0.05</td><td>0.6±0.05</td><td>0.5±0.05</td><td>0.5±0.05</td></tr><tr><td>GNM214</td><td>2.0±0.05</td><td>0.7±0.05</td><td>0.3±0.05</td><td>0.2±0.05</td></tr><tr><td>GNM314</td><td>2.5±0.05</td><td>0.8±0.05</td><td>0.4±0.05</td><td>0.4±0.05</td></tr></tbody></table><p>(in mm)</p></div><div><p>•GNM□□2</p><p>(in mm)</p></div></div> |                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Type | a    | b    | c | d | GNM1M2 | 2.0±0.05 | 0.5±0.05 | 0.32±0.05 | 0.32±0.05 | GNM212 | 2.0±0.05 | 0.6±0.05 | 0.5±0.05 | 0.5±0.05 | GNM214 | 2.0±0.05 | 0.7±0.05 | 0.3±0.05 | 0.2±0.05 | GNM314 | 2.5±0.05 | 0.8±0.05 |
| Type   | a                            | b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | c                                                                                          | d           |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| GNM1M2 | 2.0±0.05                     | 0.5±0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.32±0.05                                                                                  | 0.32±0.05   |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| GNM212 | 2.0±0.05                     | 0.6±0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.5±0.05                                                                                   | 0.5±0.05    |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| GNM214 | 2.0±0.05                     | 0.7±0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.3±0.05                                                                                   | 0.2±0.05    |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| GNM314 | 2.5±0.05                     | 0.8±0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.4±0.05                                                                                   | 0.4±0.05    |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| 13     | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |             | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
| 14     | Resistance to Soldering Heat | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |             | Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.<br><br>• Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.<br>Perform the initial measurement. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        | Appearance                   | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        | Capacitance Change           | Within ±2.5% or ±0.25pF (Whichever is larger)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | R7, R6, C7: Within ±7.5%                                                                   |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        | Q/D.F.                       | 30pF min.: $Q \geq 1000$<br>30pF max.: $Q \geq 400+20C$<br><br>C: Nominal Capacitance (pF)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Char.                                                                                      | 25V min.    |                                                                                                                                                                                                                                                                                                                                                                                                                                           | 16V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10V  | 6.3V |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        | I.R.                         | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |
|        | Dielectric Strength          | No failure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |      |   |   |        |          |          |           |           |        |          |          |          |          |        |          |          |          |          |        |          |          |

Continued on the following page.

## 2

In case Non "\*" is added in PNs table, please refer to GNM Series Specifications and Test Methods (1).  
In case "\*" is added in PNs table, please refer to GNM Series Specifications and Test Methods (2).

Continued on the following page. 

## 2

In case Non "\*" is added in PNs table, please refer to GNM Series Specifications and Test Methods (1).  
In case "\*" is added in PNs table, please refer to GNM Series Specifications and Test Methods (2).

Table A

Note 1: Nominal values denote the temperature coefficient within a range of 25 to 125°C.





# Chip Monolithic Ceramic Capacitors



## Low ESL LLL/LLA/LLM Series

3

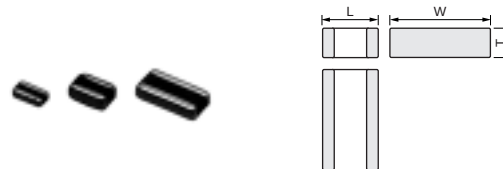
### Reversed Geometry Low ESL Type

#### ■ Features

1. Low ESL, good for noise reduction for high frequency
2. Small, high cap

#### ■ Applications

1. High speed micro processor
2. High frequency digital equipment



| Part Number | Dimensions (mm) |           |              |
|-------------|-----------------|-----------|--------------|
|             | L               | W         | T            |
| LLL153      | 0.5 ±0.05       | 1.0 ±0.05 | 0.3 ±0.05    |
| LLL185      | 0.8 ±0.1        | 1.6 ±0.1  | 0.6 max.     |
| LLL215      | 1.25 ±0.1       | 2.0 ±0.1  | 0.5 +0/-0.15 |
| LLL216      |                 |           | 0.6 ±0.1     |
| LLL219      |                 |           | 0.85 ±0.1    |
| LLL315      | 1.6 ±0.15       | 3.2 ±0.15 | 0.5 +0/-0.15 |
| LLL317      |                 |           | 0.7 ±0.1     |
| LLL31M      |                 |           | 1.15 ±0.1    |

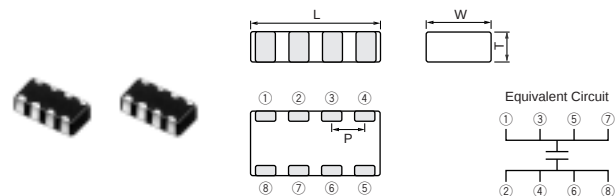
### Eight Terminals Low ESL Type

#### ■ Features

1. Low ESL (100pH) , suitable to decoupling capacitor for 1GHz clock speed IC.
2. Small, large cap

#### ■ Applications

1. High speed micro processor
2. High frequency digital equipment



| Part Number | Dimensions (mm) |           |                |           |
|-------------|-----------------|-----------|----------------|-----------|
|             | L               | W         | T              | P         |
| LLA185      | 1.6 ±0.1        | 0.8 ±0.1  | 0.5 +0.05/-0.1 | 0.4 ±0.1  |
| LLA215      | 2.0 ±0.1        | 1.25 ±0.1 | 0.5 +0.05/-0.1 | 0.5 ±0.05 |
| LLA219      | 2.0 ±0.1        | 1.25 ±0.1 | 0.85 ±0.1      | 0.5 ±0.05 |
| LLA315      | 3.2 ±0.15       | 1.6 ±0.15 | 0.5 +0.05/-0.1 | 0.8 ±0.1  |
| LLA319      | 3.2 ±0.15       | 1.6 ±0.15 | 0.85 ±0.1      | 0.8 ±0.1  |
| LLA31M      | 3.2 ±0.15       | 1.6 ±0.15 | 1.15 ±0.1      | 0.8 ±0.1  |

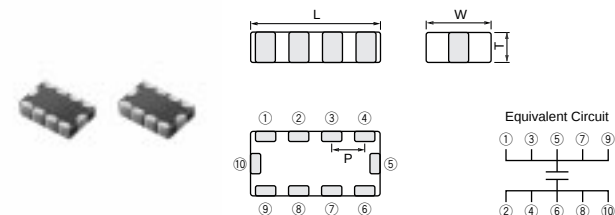
### Ten Terminals Low ESL Type

#### ■ Features

1. Low ESL (45pH), suitable to decoupling capacitor for 2GHz clock speed IC.
2. Small, large cap

#### ■ Applications

1. High speed micro processor
2. High frequency digital equipment



| Part Number | Dimensions (mm) |           |                |           |
|-------------|-----------------|-----------|----------------|-----------|
|             | L               | W         | T              | P         |
| LLM215      | 2.0 ±0.1        | 1.25 ±0.1 | 0.5 +0.05/-0.1 | 0.5 ±0.05 |
| LLM315      | 3.2 ±0.15       | 1.6 ±0.15 | 0.5 +0.05/-0.1 | 0.8 ±0.1  |

Capacitance Table

Reversed Geometry Low ESL Type X7R(R7)/X7S(C7)/X6S(C8)/X5R(R6) Characteristics

5ex.5: T Dimension [mm]

| LxW<br>[mm]  | 0.5x1.0<br>(15)<br><0204> |             | 0.8x1.6<br>(18)<br><0306> |             |             |             |             | 1.25x2.0<br>(21)<br><0508> |             |             |             |             | 1.6x3.2<br>(31)<br><0612> |             |             |             |             |             |
|--------------|---------------------------|-------------|---------------------------|-------------|-------------|-------------|-------------|----------------------------|-------------|-------------|-------------|-------------|---------------------------|-------------|-------------|-------------|-------------|-------------|
|              | 6.3<br>(0J)               | 4<br>(0G)   | 50<br>(1H)                | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  | 4<br>(0G)   | 50<br>(1H)                 | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  | 4<br>(0G)   | 50<br>(1H)                | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  | 6.3<br>(0J) |             |
| TC           | X6S<br>(C8)               | X7S<br>(C7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X5R<br>(R6) |
| Capacitance  | 2200pF(222)               |             | 5                         |             |             |             |             |                            |             |             |             |             |                           |             |             |             |             |             |
| 4700pF(472)  |                           |             | 5                         |             |             |             |             |                            |             |             |             |             |                           |             |             |             |             |             |
| 10000pF(103) |                           |             |                           | 5           |             |             |             | 6                          |             |             |             |             | 7                         |             |             |             |             |             |
| 22000pF(223) |                           |             |                           | 5           |             |             |             | 6                          |             |             |             |             | 7                         |             |             |             |             |             |
| 47000pF(473) |                           |             |                           |             | 5           |             |             |                            | 6           |             |             |             | 7                         |             |             |             |             |             |
| 0.10μF(104)  | 3                         |             |                           |             |             | 5           |             |                            | 6           |             |             |             | M                         | 7           |             |             |             |             |
| 0.22μF(224)  | 3                         |             |                           |             |             | 5           |             |                            |             | 9           | 6           |             |                           | M           | 7           |             |             |             |
| 0.47μF(474)  |                           | 3           |                           |             |             |             | 5           |                            |             |             | 9           |             |                           | M           | 7           |             |             |             |
| 1.0μF(105)   |                           |             |                           |             |             |             | 5           |                            |             |             | 9           |             |                           |             | M           | 7           |             |             |
| 2.2μF(225)   |                           |             |                           |             |             |             | 5           |                            |             |             |             | 9           |                           |             |             | M           | 7           |             |
| 4.7μF(475)   |                           |             |                           |             |             |             |             |                            |             |             |             |             |                           |             |             |             | M           |             |
| 10μF(106)    |                           |             |                           |             |             |             |             |                            |             |             |             |             |                           |             |             |             |             | M           |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

Reversed Geometry Low ESL Type X7R(R7)/X7S(C7) Characteristics Low Profile

5ex.5: T Dimension [mm]

| LxW<br>[mm]            | 0.8x1.6<br>(18)<br><0306> |             |             |             | 1.25x2.0<br>(21)<br><0508> |             |             |             |             |             | 1.6x3.2<br>(31)<br><0612> |             |             |             |
|------------------------|---------------------------|-------------|-------------|-------------|----------------------------|-------------|-------------|-------------|-------------|-------------|---------------------------|-------------|-------------|-------------|
|                        | 25<br>(1E)                | 16<br>(1C)  | 10<br>(1A)  | 4<br>(0G)   | 50<br>(1H)                 | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  | 6.3<br>(0J) | 4<br>(0G)   | 50<br>(1H)                | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  |
| Rated Voltage<br>[Vdc] | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) |
| TC                     | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) |
| Capacitance            | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) |
| 10000pF(103)           | 5                         |             |             |             | 5                          |             |             |             |             |             | 5                         |             |             |             |
| 22000pF(223)           |                           | 5           |             |             |                            | 5           |             |             |             |             | 5                         |             |             |             |
| 47000pF(473)           |                           | 5           |             |             |                            |             | 5           |             |             |             |                           | 5           |             |             |
| 0.10μF(104)            |                           |             | 5           |             |                            |             | 5           |             |             |             |                           | 5           |             |             |
| 0.22μF(224)            |                           |             |             | 5           |                            |             |             | 5           |             |             |                           |             | 5           |             |
| 0.47μF(474)            |                           |             |             |             |                            |             |             |             | 5           |             |                           |             |             | 5           |
| 1.0μF(105)             |                           |             |             |             |                            |             |             |             |             | 5           |                           |             |             |             |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

Continued on the following page. ↗

## Capacitance Table

Continued from the preceding page.

### Eight Terminals Low ESL Type X7S(C7)/X7R(R7) Characteristics

| 5            |                        | ex.5: T Dimension [mm] |                           |             |             |             |             |                            |             |             |
|--------------|------------------------|------------------------|---------------------------|-------------|-------------|-------------|-------------|----------------------------|-------------|-------------|
| LxW<br>[mm]  | Rated Voltage<br>[Vdc] | TC                     | 1.6x0.8<br>(18)<br><0603> |             |             |             |             | 2.0x1.25<br>(21)<br><0805> |             |             |
|              |                        |                        | 4<br>(0G)                 | 25<br>(1E)  | 16<br>(1C)  | 10<br>(1A)  | 6.3<br>(0J) | 4<br>(0G)                  | 16<br>(1C)  | 10<br>(1A)  |
| Capacitance  |                        |                        | X7S<br>(C7)               | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7)                | X7R<br>(R7) | X7R<br>(R7) |
|              |                        |                        |                           |             |             |             |             |                            |             |             |
| 10000pF(103) |                        |                        |                           | 9           |             |             |             |                            |             |             |
| 22000pF(223) |                        |                        |                           | 9           |             |             |             |                            |             |             |
| 47000pF(473) |                        |                        |                           | 9           |             |             |             |                            |             |             |
| 0.10μF(104)  | 5                      |                        |                           |             | 9           |             |             |                            | 9           |             |
| 0.22μF(224)  | 5                      |                        |                           |             | 9           |             |             |                            | 9           |             |
| 0.47μF(474)  | 5                      |                        |                           |             |             | 9           |             |                            | 9           |             |
| 1.0μF(105)   | 5                      |                        |                           |             |             |             | 9           |                            | M           | 9           |
| 2.2μF(225)   | 5                      |                        |                           |             |             |             |             | 9                          |             | M           |
| 4.7μF(475)   |                        |                        |                           |             |             |             |             | 9                          |             |             |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

### Eight Terminals Low ESL Type X7R(R7)/X7S(C7) Characteristics Low Profile

| 5            |                        | ex.5: T Dimension [mm] |                            |             |             |             |             |                           |             |             |
|--------------|------------------------|------------------------|----------------------------|-------------|-------------|-------------|-------------|---------------------------|-------------|-------------|
| LxW<br>[mm]  | Rated Voltage<br>[Vdc] | TC                     | 2.0x1.25<br>(21)<br><0805> |             |             |             |             | 3.2x1.6<br>(31)<br><1206> |             |             |
|              |                        |                        | 25<br>(1E)                 | 16<br>(1C)  | 10<br>(1A)  | 6.3<br>(0J) | 4<br>(0G)   | 16<br>(1C)                | 10<br>(1A)  | 6.3<br>(0J) |
| Capacitance  |                        |                        | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7)               | X7R<br>(R7) | X7R<br>(R7) |
|              |                        |                        |                            |             |             |             |             |                           |             |             |
| 10000pF(103) | 5                      |                        |                            |             |             |             |             |                           |             |             |
| 22000pF(223) | 5                      |                        |                            |             |             |             |             |                           |             |             |
| 47000pF(473) |                        |                        |                            | 5           |             |             |             |                           |             |             |
| 0.10μF(104)  |                        |                        |                            | 5           |             |             |             |                           |             |             |
| 0.22μF(224)  |                        |                        |                            |             | 5           |             |             | 5                         |             |             |
| 0.47μF(474)  |                        |                        |                            |             |             | 5           |             |                           | 5           |             |
| 1.0μF(105)   |                        |                        |                            |             |             |             | 5           |                           |             | 5           |
| 2.2μF(225)   |                        |                        |                            |             |             |             | 5           |                           |             | 5           |
| 4.7μF(475)   |                        |                        |                            |             |             |             | 5           |                           |             |             |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

### Ten Terminals Low ESL Type X7R(R7)/X7S(C7) Characteristics Low Profile

| 5            |                        | ex.5: T Dimension [mm] |                            |             |             |             |             |                           |             |  |
|--------------|------------------------|------------------------|----------------------------|-------------|-------------|-------------|-------------|---------------------------|-------------|--|
| LxW<br>[mm]  | Rated Voltage<br>[Vdc] | TC                     | 2.0x1.25<br>(21)<br><0805> |             |             |             |             | 3.2x1.6<br>(31)<br><1206> |             |  |
|              |                        |                        | 25<br>(1E)                 | 16<br>(1C)  | 6.3<br>(0J) | 4<br>(0G)   | 16<br>(1C)  | 10<br>(1A)                | 6.3<br>(0J) |  |
| Capacitance  |                        |                        | X7R<br>(R7)                | X7R<br>(R7) | X7R<br>(R7) | X7S<br>(C7) | X7R<br>(R7) | X7R<br>(R7)               | X7R<br>(R7) |  |
|              |                        |                        |                            |             |             |             |             |                           |             |  |
| 10000pF(103) | 5                      |                        |                            |             |             |             |             |                           |             |  |
| 22000pF(223) | 5                      |                        |                            |             |             |             |             |                           |             |  |
| 47000pF(473) |                        |                        |                            | 5           |             |             |             |                           |             |  |
| 0.10μF(104)  |                        |                        |                            | 5           |             |             | 5           |                           |             |  |
| 0.22μF(224)  |                        |                        |                            |             | 5           |             | 5           |                           |             |  |
| 0.47μF(474)  |                        |                        |                            |             | 5           |             |             | 5                         |             |  |
| 1.0μF(105)   |                        |                        |                            |             |             | 5           |             |                           |             |  |
| 2.2μF(225)   |                        |                        |                            |             |             | 5           |             |                           | 5           |  |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Reversed Geometry Low ESL Type X7R(R7)/X7S(C7)/X6S(C8) Characteristics

| LxW [mm]          |           | 0.5x1.0(15)<0204>   |       |
|-------------------|-----------|---------------------|-------|
| Rated Volt. [Vdc] |           | 6.3(0J)             | 4(0G) |
| Capacitance       | Tolerance | Part Number         |       |
| 0.10μF(104)       | ±20%(M)   | LLL153C80J104ME01E* |       |
| 0.22μF(224)       | ±20%(M)   | LLL153C80J224ME14E* |       |
| 0.47μF(474)       | ±20%(M)   | LLL153C70G474ME17E* |       |

LLL153 Series 4V/0.47μF(L: 0.5+0.07/-0.03mm)

| LxW [mm]          |           | 0.8x1.6(18)<0306>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 2200pF(222)       | ±20%(M)   | LLL185R71H222MA01L |                    |                    |                    |
| 4700pF(472)       | ±20%(M)   | LLL185R71H472MA01L |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   |                    | LLL185R71E103MA01L |                    |                    |
| 22000pF(223)      | ±20%(M)   |                    | LLL185R71E223MA01L |                    |                    |
| 47000pF(473)      | ±20%(M)   |                    |                    | LLL185R71C473MA01L |                    |
| 0.10μF(104)       | ±20%(M)   |                    |                    |                    | LLL185R71A104MA01L |
| 0.22μF(224)       | ±20%(M)   |                    |                    |                    | LLL185R71A224MA01L |

| LxW [mm]          |           | 0.8x1.6(18)<0306>   |  |
|-------------------|-----------|---------------------|--|
| Rated Volt. [Vdc] |           | 4(0G)               |  |
| Capacitance       | Tolerance | Part Number         |  |
| 0.47μF(474)       | ±20%(M)   | LLL185C70G474MA01L  |  |
| 1.0μF(105)        | ±20%(M)   | LLL185C70G105ME02L* |  |
| 2.2μF(225)        | ±20%(M)   | LLL185C70G225ME01L* |  |

| LxW [mm]          |           | 1.25x2.0(21)<0508> |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLL216R71H103MA01L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   | LLL216R71H223MA01L |                    |                    |                    |
| 47000pF(473)      | ±20%(M)   |                    | LLL216R71E473MA01L |                    |                    |
| 0.10μF(104)       | ±20%(M)   |                    | LLL216R71E104MA01L |                    |                    |
| 0.22μF(224)       | ±20%(M)   |                    |                    | LLL219R71C224MA01L | LLL216R71A224MA01L |
| 0.47μF(474)       | ±20%(M)   |                    |                    |                    | LLL219R71A474MA01L |
| 1.0μF(105)        | ±20%(M)   |                    |                    |                    | LLL219R71A105MA01L |

| LxW [mm]          |           | 1.25x2.0(21)<0508> |  |
|-------------------|-----------|--------------------|--|
| Rated Volt. [Vdc] |           | 4(0G)              |  |
| Capacitance       | Tolerance | Part Number        |  |
| 2.2μF(225)        | ±20%(M)   | LLL219C70G225MA01L |  |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

(Part Number) **LL** **L** **15** **3** **C8** **0J** **104** **M** **E01** **E**
①Product ID    ②Series
③Dimension (LxW)    ④Dimension (T)
⑤Temperature Characteristics    ⑥Rated Voltage
⑦Capacitance
⑧Capacitance Tolerance    ⑨Individual Specification Code    ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Reversed Geometry Low ESL Type X7R(R7)/X5R(R6) Characteristics

| LxW [mm]          |           | 1.6x3.2(31)<0612>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLL317R71H103MA01L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   | LLL317R71H223MA01L |                    |                    |                    |
| 47000pF(473)      | ±20%(M)   | LLL317R71H473MA01L |                    |                    |                    |
| 0.10μF(104)       | ±20%(M)   | LLL31MR71H104MA01L | LLL317R71E104MA01L |                    |                    |
| 0.22μF(224)       | ±20%(M)   |                    | LLL31MR71E224MA01L | LLL317R71C224MA01L |                    |
| 0.47μF(474)       | ±20%(M)   |                    | LLL31MR71E474MA01L | LLL317R71C474MA01L |                    |
| 1.0μF(105)        | ±20%(M)   |                    |                    | LLL31MR71C105MA01L | LLL317R71A105MA01L |
| 2.2μF(225)        | ±20%(M)   |                    |                    |                    | LLL31MR71A225MA01L |

| LxW [mm]          |           | 1.6x3.2(31)<0612>   |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |
| 2.2μF(225)        | ±20%(M)   | LLL317R70J225MA01L  |
| 4.7μF(475)        | ±20%(M)   | LLL31MR70J475MA01L  |
| 10μF(106)         | ±20%(M)   | LLL31MR60J106ME01L* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

## Reversed Geometry Low ESL Type X7R(R7)/X7S(C7) Characteristics Low Profile

| LxW [mm]          |           | 0.8x1.6(18)<0306>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 25(1E)             | 16(1C)             | 10(1A)             | 4(0G)              |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLL185R71E103MA11L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   |                    | LLL185R71C223MA11L |                    |                    |
| 47000pF(473)      | ±20%(M)   |                    | LLL185R71C473MA11L |                    |                    |
| 0.10μF(104)       | ±20%(M)   |                    |                    | LLL185R71A104MA11L |                    |
| 0.22μF(224)       | ±20%(M)   |                    |                    |                    | LLL185C70G224MA11L |

| LxW [mm]          |           | 1.25x2.0(21)<0508> |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLL215R71H103MA11L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   |                    | LLL215R71E223MA11L |                    |                    |
| 47000pF(473)      | ±20%(M)   |                    |                    | LLL215R71C473MA11L |                    |
| 0.10μF(104)       | ±20%(M)   |                    |                    | LLL215R71C104MA11L |                    |
| 0.22μF(224)       | ±20%(M)   |                    |                    |                    | LLL215R71A224MA11L |

| LxW [mm]          |           | 1.25x2.0(21)<0508> |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 6.3(0J)            | 4(0G)              |
| Capacitance       | Tolerance | Part Number        |                    |
| 0.47μF(474)       | ±20%(M)   | LLL215R70J474MA11L |                    |
| 1.0μF(105)        | ±20%(M)   |                    | LLL215C70G105MA11L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

(Part Number) LL L 31 7 R7 1H 103 M A01 L

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①Product ID

②Series

⑤Temperature Characteristics

⑧Capacitance Tolerance

③Dimension (LxW)

⑥Rated Voltage

⑨Individual Specification Code

④Dimension (T)

⑦Capacitance

⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Reversed Geometry Low ESL Type X7R(R7) Characteristics Low Profile

| LxW [mm]          |           | 1.6x3.2(31)<0612>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLL315R71H103MA11L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   | LLL315R71H223MA11L |                    |                    |                    |
| 47000pF(473)      | ±20%(M)   |                    | LLL315R71E473MA11L |                    |                    |
| 0.10μF(104)       | ±20%(M)   |                    | LLL315R71E104MA11L |                    |                    |
| 0.22μF(224)       | ±20%(M)   |                    |                    | LLL315R71C224MA11L |                    |
| 0.47μF(474)       | ±20%(M)   |                    |                    |                    | LLL315R71A474MA11L |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

## Eight Terminals Low ESL Type X7R(R7)/X7S(C7) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603>   |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |
| 0.10μF(104)       | ±20%(M)   | LLA185C70G104MA01L  |
| 0.22μF(224)       | ±20%(M)   | LLA185C70G224MA01L  |
| 0.47μF(474)       | ±20%(M)   | LLA185C70G474MA01L  |
| 1.0μF(105)        | ±20%(M)   | LLA185C70G105ME01L* |
| 2.2μF(225)        | ±20%(M)   | LLA185C70G225ME16L* |

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 25(1E)             | 16(1C)             | 10(1A)             | 6.3(0J)            |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLA219R71E103MA01L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   | LLA219R71E223MA01L |                    |                    |                    |
| 47000pF(473)      | ±20%(M)   | LLA219R71E473MA01L |                    |                    |                    |
| 0.10μF(104)       | ±20%(M)   |                    | LLA219R71C104MA01L |                    |                    |
| 0.22μF(224)       | ±20%(M)   |                    | LLA219R71C224MA01L |                    |                    |
| 0.47μF(474)       | ±20%(M)   |                    |                    | LLA219R71A474MA01L |                    |
| 1.0μF(105)        | ±20%(M)   |                    |                    |                    | LLA219R70J105MA01L |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |
| 2.2μF(225)        | ±20%(M)   | LLA219C70G225MA01L  |
| 4.7μF(475)        | ±20%(M)   | LLA219C70G475ME01L* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>  |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 16(1C)             | 10(1A)             | 4(0G)              |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 0.10μF(104)       | ±20%(M)   | LLA319R71C104MA01L |                    |                    |
| 0.22μF(224)       | ±20%(M)   | LLA319R71C224MA01L |                    |                    |
| 0.47μF(474)       | ±20%(M)   | LLA319R71C474MA01L |                    |                    |
| 1.0μF(105)        | ±20%(M)   | LLA31MR71C105MA01L | LLA319R71A105MA01L |                    |
| 2.2μF(225)        | ±20%(M)   |                    | LLA31MR71A225MA01L | LLA319R70G225MA01L |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

Eight Terminals Low ESL Type X7R(R7)/X7S(C7) Characteristics Low Profile

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 25(1E)             | 16(1C)             | 10(1A)             | 6.3(0J)            |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 10000pF(103)      | ±20%(M)   | LLA215R71E103MA14L |                    |                    |                    |
| 22000pF(223)      | ±20%(M)   | LLA215R71E223MA14L |                    |                    |                    |
| 47000pF(473)      | ±20%(M)   |                    | LLA215R71C473MA14L |                    |                    |
| 0.10μF(104)       | ±20%(M)   |                    | LLA215R71C104MA14L |                    |                    |
| 0.22μF(224)       | ±20%(M)   |                    |                    | LLA215R71A224MA14L |                    |
| 0.47μF(474)       | ±20%(M)   |                    |                    |                    | LLA215R70J474MA14L |

| LxW [mm]          |           | 2.0x1.25(21)<0805>  |
|-------------------|-----------|---------------------|
| Rated Volt. [Vdc] |           | 4(0G)               |
| Capacitance       | Tolerance | Part Number         |
| 1.0μF(105)        | ±20%(M)   | LLA215C70G105MA14L  |
| 2.2μF(225)        | ±20%(M)   | LLA215C70G225ME11L* |
| 4.7μF(475)        | ±20%(M)   | LLA215C70G475ME19L* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>  |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 16(1C)             | 10(1A)             | 6.3(0J)            |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 0.22μF(224)       | ±20%(M)   | LLA315R71C224MA14L |                    |                    |
| 0.47μF(474)       | ±20%(M)   |                    | LLA315R71A474MA14L |                    |
| 1.0μF(105)        | ±20%(M)   |                    |                    | LLA315R70J105MA14L |
| 2.2μF(225)        | ±20%(M)   |                    |                    | LLA315R70J225MA14L |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code  
\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

Ten Terminals Low ESL Type X7R(R7)/X7S(C7) Characteristics Low Profile

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    |                    |                     |
|-------------------|-----------|--------------------|--------------------|--------------------|---------------------|
| Rated Volt. [Vdc] |           | 25(1E)             | 16(1C)             | 6.3(0J)            | 4(0G)               |
| Capacitance       | Tolerance | Part Number        |                    |                    |                     |
| 10000pF(103)      | ±20%(M)   | LLM215R71E103MA11L |                    |                    |                     |
| 22000pF(223)      | ±20%(M)   | LLM215R71E223MA11L |                    |                    |                     |
| 47000pF(473)      | ±20%(M)   |                    | LLM215R71C473MA11L |                    |                     |
| 0.10μF(104)       | ±20%(M)   |                    | LLM215R71C104MA11L |                    |                     |
| 0.22μF(224)       | ±20%(M)   |                    |                    | LLM215R70J224MA11L |                     |
| 0.47μF(474)       | ±20%(M)   |                    |                    | LLM215R70J474MA11L |                     |
| 1.0μF(105)        | ±20%(M)   |                    |                    |                    | LLM215C70G105MA11L  |
| 2.2μF(225)        | ±20%(M)   |                    |                    |                    | LLM215C70G225ME11L* |

| LxW [mm]          |           | 3.2x1.6(31)<1206>  |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 16(1C)             | 10(1A)             | 6.3(0J)            |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 0.10μF(104)       | ±20%(M)   | LLM315R71C104MA11L |                    |                    |
| 0.22μF(224)       | ±20%(M)   | LLM315R71C224MA11L |                    |                    |
| 0.47μF(474)       | ±20%(M)   |                    | LLM315R71A474MA11L |                    |
| 2.2μF(225)        | ±20%(M)   |                    |                    | LLM315R70J225MA11L |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code  
\*: Please refer to LLL/LLA/LLM Series Specifications and Test Method(2).

(Part Number) 

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①Product ID

②Series

③Dimension (LxW)

④Dimension (T)

⑤Temperature Characteristics

⑥Rated Voltage

⑦Capacitance

⑧Capacitance Tolerance

⑨Individual Specification Code

⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## LLL/LLA/LLM Series Specifications and Test Methods (1)

In case Non "\*" is added in PNs table, please refer to LLL/LLA/LLM Series Specifications and Test Methods (1).  
 In case "\*" is added in PNs table, please refer to LLL/LLA/LLM Series Specifications and Test Methods (2).

| No.   | Item                                    |                     | Specifications                                                                                                                                                                                                                                               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|-------|-----------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|------------|----|-------------|------|-------------|----|-------------|------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|---|------|---|-------|---|------|---|-------|---|------|
| 1     | Operating Temperature Range             |                     | R7, C7: −55 to +125°C                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 2     | Rated Voltage                           |                     | See the previous pages.                                                                                                                                                                                                                                      | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                             |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 3     | Appearance                              |                     | No defects or abnormalities                                                                                                                                                                                                                                  | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 4     | Dimensions                              |                     | Within the specified dimension                                                                                                                                                                                                                               | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 5     | Dielectric Strength                     |                     | No defects or abnormalities                                                                                                                                                                                                                                  | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                            |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 6     | Insulation Resistance                   |                     | C≤0.047μF: More than 10,000MΩ<br>C>0.047μF: More than 500Ω · F<br>C: Normal Capacitance                                                                                                                                                                      | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                  |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 7     | Capacitance                             |                     | Within the specified tolerance                                                                                                                                                                                                                               | The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.<br>Frequency: 1±0.1kHz<br>Voltage: 1±0.2Vrms<br>*For LLA185C70G474, the capacitance should be measured unsing a voltage of 0.5±0.1Vrms.                                                                                                                                                                                                                                                                                                 |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 8     | Dissipation Factor (D.F.)               |                     | W.V.: 25V min.; 0.025 max.<br>W.V.: 16V/10V max.; 0.035 max.<br>W.V.: 6.3V max.; 0.05 max.                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 9     | Capacitance Temperature Characteristics |                     | <table><tr><th>Char.</th><th>Temp. Range (°C)</th><th>Reference Temp.</th><th>Cap.Change</th></tr><tr><td>R7</td><td>−55 to +125</td><td>25°C</td><td>Within ±15%</td></tr><tr><td>C7</td><td>−55 to +125</td><td>25°C</td><td>Within ±22%</td></tr></table> | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Temp. Range (°C) | Reference Temp. | Cap.Change | R7 | −55 to +125 | 25°C | Within ±15% | C7 | −55 to +125 | 25°C | Within ±22% | <p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>25±2</td></tr></table> <p>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</p> <ul style="list-style-type: none"><li>Initial measurement.</li></ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement.</p> | Step | Temperature (°C) | 1 | 25±2 | 2 | −55±3 | 3 | 25±2 | 4 | 125±3 | 5 | 25±2 |
| Char. | Temp. Range (°C)                        | Reference Temp.     | Cap.Change                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| R7    | −55 to +125                             | 25°C                | Within ±15%                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| C7    | −55 to +125                             | 25°C                | Within ±22%                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| Step  | Temperature (°C)                        |                     |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 1     | 25±2                                    |                     |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 2     | −55±3                                   |                     |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 3     | 25±2                                    |                     |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 4     | 125±3                                   |                     |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 5     | 25±2                                    |                     |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 10    | Adhesive Strength of Termination        |                     | No removal of the terminations or other defect should occur.                                                                                                                                                                                                 | Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>*LLL18 and LLA/LLM Series: 5N                                                                                                                                                              |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 11    | Vibration Resistance                    | Appearance          | No defects or abnormalities                                                                                                                                                                                                                                  | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|       |                                         | Capacitance         | Within the specified tolerance                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|       |                                         | D.F.                | W.V.: 25V min.; 0.025 max.<br>W.V.: 16V/10V max.; 0.035 max.<br>W.V.: 6.3V max.; 0.05 max.                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 12    | Solderability of Termination            |                     | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                          | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.                                                                                                                                                                                                                    |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
| 13    | Resistance to Soldering Heat            | Appearance          | No marking defects                                                                                                                                                                                                                                           | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.</p> <ul style="list-style-type: none"><li>Initial measurement.</li></ul> <p>Perform a heat treatment at 150±5°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p>                                                                                      |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|       |                                         | Capacitance Change  | Within ±7.5%                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|       |                                         | D.F.                | W.V.: 25V min.; 0.025 max.<br>W.V.: 16V/10V max.; 0.035 max.<br>W.V.: 6.3V max.; 0.05 max.                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|       |                                         | I.R.                | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |
|       |                                         | Dielectric Strength | No failure                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |            |    |             |      |             |    |             |      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |       |   |      |

Continued on the following page. 

## 3

Continued from the preceding page.

| Step        | 1                                          | 2          | 3                                          | 4          |
|-------------|--------------------------------------------|------------|--------------------------------------------|------------|
| Temp. (°C)  | Min. Operating Temp. $+30^{\circ}\text{C}$ | Room Temp. | Max. Operating Temp. $+30^{\circ}\text{C}$ | Room Temp. |
| Time (min.) | 30±3                                       | 2 to 3     | 30±3                                       | 2 to 3     |

## LLL/LLA/LLM Series Specifications and Test Methods (2)

In case Non "\*\*\*" is added in PNs table, please refer to LLL/LLA/LLM Series Specifications and Test Methods (1).  
 In case "\*\*\*" is added in PNs table, please refer to LLL/LLA/LLM Series Specifications and Test Methods (2).

| No.                | Item                                    |                     | Specifications                                                                                                                                                                                                                                                                                                                                                                      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|-----------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|-------------|-------------------|------------|-------------|--------------------|----------|-------------|-------------|----------|-------------|-------------|----|-------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                  | Operating Temperature Range             |                     | R6: -55 to +85°C<br>R7, C7: -55 to +125°C<br>C8: -55 to +105°C                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 2                  | Rated Voltage                           |                     | See the previous pages.                                                                                                                                                                                                                                                                                                                                                             | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, V <sup>P-P</sup> or V <sup>O-P</sup> , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                               |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 3                  | Appearance                              |                     | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                         | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 4                  | Dimensions                              |                     | Within the specified dimension                                                                                                                                                                                                                                                                                                                                                      | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 5                  | Dielectric Strength                     |                     | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                         | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                            |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 6                  | Insulation Resistance                   |                     | 50Ω · F min.                                                                                                                                                                                                                                                                                                                                                                        | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 1 minute of charging.                                                                                                                                                                                                                                                                                                                                                                                   |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 7                  | Capacitance                             |                     | Within the specified tolerance                                                                                                                                                                                                                                                                                                                                                      | The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 8                  | Dissipation Factor (D.F.)               |                     | R6, R7, C7, C8: 0.120 max.                                                                                                                                                                                                                                                                                                                                                          | <table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>C≤10μF (10V min.)</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>C≤10μF (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>C&gt;10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr></table>                                                                                                                                                                                                                                          | Capacitance      | Frequency       | Voltage     | C≤10μF (10V min.) | 1±0.1kHz   | 1.0±0.2Vrms | C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | C>10μF      | 120±24Hz | 0.5±0.1Vrms |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Capacitance        | Frequency                               | Voltage             |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| C≤10μF (10V min.)  | 1±0.1kHz                                | 1.0±0.2Vrms         |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| C≤10μF (6.3V max.) | 1±0.1kHz                                | 0.5±0.1Vrms         |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| C>10μF             | 120±24Hz                                | 0.5±0.1Vrms         |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 9                  | Capacitance Temperature Characteristics |                     | <table><tr><th>Char.</th><th>Temp. Range (°C)</th><th>Reference Temp.</th><th>Cap. Change</th></tr><tr><td>R6</td><td>-55 to +85</td><td rowspan="4">25°C</td><td>Within ±15%</td></tr><tr><td>R7</td><td>-55 to +125</td><td>Within ±15%</td></tr><tr><td>C7</td><td>-55 to +125</td><td>Within ±22%</td></tr><tr><td>C8</td><td>-55 to +105</td><td>Within ±22%</td></tr></table> | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Temp. Range (°C) | Reference Temp. | Cap. Change | R6                | -55 to +85 | 25°C        | Within ±15%        | R7       | -55 to +125 | Within ±15% | C7       | -55 to +125 | Within ±22% | C8 | -55 to +105 | Within ±22% | The capacitance change should be measured after 5 min. at each specified temperature stage.<br>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.<br><br>• Initial measurement.<br>Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement. |
| Char.              | Temp. Range (°C)                        | Reference Temp.     | Cap. Change                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| R6                 | -55 to +85                              | 25°C                | Within ±15%                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| R7                 | -55 to +125                             |                     | Within ±15%                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| C7                 | -55 to +125                             |                     | Within ±22%                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| C8                 | -55 to +105                             |                     | Within ±22%                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 10                 | Adhesive Strength of Termination        |                     | No removal of the terminations or other defect should occur.                                                                                                                                                                                                                                                                                                                        | Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>*5N (LLL15, LLL18, LLA,LLM Series)                                                                                                                                                         |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 11                 | Vibration                               | Appearance          | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                         | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                    |                                         | Capacitance         | Within the specified tolerance                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                    |                                         | D.F.                | R6, R7, C7, C8: 0.120 max.                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 12                 | Solderability of Termination            |                     | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                                                                                 | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.                                                                                                                                                                                                                    |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 13                 | Resistance to Soldering Heat            | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                  | Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds.<br>Let sit at room temperature for 24±2 hours, then measure.<br><br>• Initial measurement.<br>Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.                                                                                                                                    |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                    |                                         | Capacitance Change  | R6, R7, C7, C8: Within ±7.5%                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                    |                                         | D.F.                | R6, R7, C7, C8: 0.120 max.                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                    |                                         | I.R.                | 50Ω · F min.                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                    |                                         | Dielectric Strength | No failure                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |             |                   |            |             |                    |          |             |             |          |             |             |    |             |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |

Continued on the following page. ➤

## LLL/LLA/LLM Series Specifications and Test Methods (2)

Continued from the preceding page. In case Non "\*" is added in PNs table, please refer to LLL/LLA/LLM Series Specifications and Test Methods (1).  
 In case "\*" is added in PNs table, please refer to LLL/LLA/LLM Series Specifications and Test Methods (2).

| No.                 | Item                                          |                    | Specifications                                                | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|---------------------|-----------------------------------------------|--------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------|------------|---|---|------------|-------------------------|------------|-------------------------|------------|-------------|------|--------|------|--------|
| 14                  | Temperature Sudden Change                     | Appearance         | No marking defects                                            | <div>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.</div> <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. ±3</td><td>Room Temp.</td><td>Min. Operating Temp. ±3</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table> <div>• Initial measurement<br/>Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</div> | Step       | 1                       | 2          | 3 | 4 | Temp. (°C) | Min. Operating Temp. ±3 | Room Temp. | Min. Operating Temp. ±3 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
|                     |                                               | Step               | 1                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2          | 3                       | 4          |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | Temp. (°C)         | Min. Operating Temp. ±3                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Room Temp. | Min. Operating Temp. ±3 | Room Temp. |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | Time (min.)        | 30±3                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 to 3     | 30±3                    | 2 to 3     |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | Capacitance Change | R6, R7, C7, C8: Within ±12.5%                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
| D.F.                | R6, R7, C7, C8: 0.120 max.                    |                    |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
| I.R.                | 50Ω · F min.                                  |                    |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
| Dielectric Strength | No failure                                    |                    |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
| 15                  | High Temperature High Humidity (Steady State) | Appearance         | No marking defects                                            | <div>Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours.<br/>The charge/discharge current is less than 50mA.<br/>Apply the rated DC voltage.</div> <div>•Initial measurement<br/>Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</div> <div>•Measurement after test<br/>Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</div>                                                                                                                                                                                                                                    |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | Capacitance Change | R6, R7, C7, C8: Within ±12.5%                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | D.F.               | R6, R7, C7, C8: 0.2 max.                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | I.R.               | 12.5Ω · F min.                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               |                    |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
| 16                  | Durability                                    | Appearance         | No marking defects                                            | <div>Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C.<br/>The charge/discharge current is less than 50mA.</div> <div>•Initial measurement<br/>Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</div> <div>•Measurement after test<br/>Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</div>                                                                                                                                                                                                                                                  |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | Capacitance Change | R6, R7, C7, C8: Within ±12.5%<br>* LLL153C70G474: Within ±20% |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | D.F.               | R6, R7, C7, C8: 0.2 max.                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               | I.R.               | 25Ω · F min.                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |
|                     |                                               |                    |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                         |            |   |   |            |                         |            |                         |            |             |      |        |      |        |

# Chip Monolithic Ceramic Capacitors



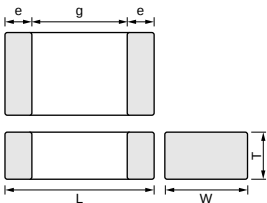
## High-Q Type GJM Series

### ■ Features

- 1. Mobile Telecommunication and RF module, mainly
- 2. Quality improvement of telephone call, Low power Consumption, yield ratio improvement

### ■ Applications

VCO, PA, Mobile Telecommunication



| Part Number | Dimensions (mm) |           |           |             |        |
|-------------|-----------------|-----------|-----------|-------------|--------|
|             | L               | W         | T         | e           | g min. |
| GJM03       | 0.6 ±0.03       | 0.3 ±0.03 | 0.3 ±0.03 | 0.1 to 0.2  | 0.2    |
| GJM15       | 1.0 ±0.05       | 0.5 ±0.05 | 0.5 ±0.05 | 0.15 to 0.3 | 0.4    |

Capacitance Table

Temperature Compensating Type C0G(5C)/C0H(6C) Characteristics

| 3ex.3: T Dimension [mm] |             |                           |            |                           |
|-------------------------|-------------|---------------------------|------------|---------------------------|
| Capacitance             | LxW<br>[mm] | 0.6x0.3<br>(03)<br><0201> |            | 1.0x0.5<br>(15)<br><0402> |
|                         |             | Rated Voltage<br>[Vdc]    | 25<br>(1A) | 6.3<br>(0J)               |
| 0.1pF(R10)              |             |                           |            | 5                         |
| 0.2pF(R20)              | 3           |                           |            | 5                         |
| 0.3pF(R30)              | 3           |                           |            | 5                         |
| 0.4pF(R40)              | 3           |                           |            | 5                         |
| 0.5pF(R50)              | 3           |                           |            | 5                         |
| 0.6pF(R60)              | 3           |                           |            | 5                         |
| 0.7pF(R70)              | 3           |                           |            | 5                         |
| 0.8pF(R80)              | 3           |                           |            | 5                         |
| 0.9pF(R90)              | 3           |                           |            | 5                         |
| 1.0pF(1R0)              | 3           |                           |            | 5                         |
| 1.1pF(1R1)              | 3           |                           |            | 5                         |
| 1.2pF(1R2)              | 3           |                           |            | 5                         |
| 1.3pF(1R3)              | 3           |                           |            | 5                         |
| 1.4pF(1R4)              | 3           |                           |            | 5                         |
| 1.5pF(1R5)              | 3           |                           |            | 5                         |
| 1.6pF(1R6)              | 3           |                           |            | 5                         |
| 1.7pF(1R7)              | 3           |                           |            | 5                         |
| 1.8pF(1R8)              | 3           |                           |            | 5                         |
| 1.9pF(1R9)              | 3           |                           |            | 5                         |
| 2.0pF(2R0)              | 3           |                           |            | 5                         |
| 2.1pF(2R1)              | 3           |                           |            | 5                         |
| 2.2pF(2R2)              | 3           |                           |            | 5                         |
| 2.3pF(2R3)              | 3           |                           |            | 5                         |
| 2.4pF(2R4)              | 3           |                           |            | 5                         |
| 2.5pF(2R5)              | 3           |                           |            | 5                         |
| 2.6pF(2R6)              | 3           |                           |            | 5                         |
| 2.7pF(2R7)              | 3           |                           |            | 5                         |
| 2.8pF(2R8)              | 3           |                           |            | 5                         |
| 2.9pF(2R9)              | 3           |                           |            | 5                         |
| 3.0pF(3R0)              | 3           |                           |            | 5                         |
| 3.1pF(3R1)              | 3           |                           |            | 5                         |
| 3.2pF(3R2)              | 3           |                           |            | 5                         |
| 3.3pF(3R3)              | 3           |                           |            | 5                         |
| 3.4pF(3R4)              | 3           |                           |            | 5                         |
| 3.5pF(3R5)              | 3           |                           |            | 5                         |
| 3.6pF(3R6)              | 3           |                           |            | 5                         |
| 3.7pF(3R7)              | 3           |                           |            | 5                         |
| 3.8pF(3R8)              | 3           |                           |            | 5                         |
| 3.9pF(3R9)              | 3           |                           |            | 5                         |
| 4.0pF(4R0)              | 3           |                           |            | 5                         |
| 4.1pF(4R1)              | 3           |                           |            | 5                         |
| 4.2pF(4R2)              | 3           |                           |            | 5                         |
| 4.3pF(4R3)              | 3           |                           |            | 5                         |
| 4.4pF(4R4)              | 3           |                           |            | 5                         |
| 4.5pF(4R5)              | 3           |                           |            | 5                         |
| 4.6pF(4R6)              | 3           |                           |            | 5                         |
| 4.7pF(4R7)              | 3           |                           |            | 5                         |
| 4.8pF(4R8)              | 3           |                           |            | 5                         |
| 4.9pF(4R9)              | 3           |                           |            | 5                         |

| Capacitance | LxW<br>[mm] | 0.6x0.3<br>(03)<br><0201> |            | 1.0x0.5<br>(15)<br><0402> |
|-------------|-------------|---------------------------|------------|---------------------------|
|             |             | Rated Voltage<br>[Vdc]    | 25<br>(1A) | 6.3<br>(0J)               |
| 5.0pF(5R0)  |             | 3                         |            | 5                         |
| 5.1pF(5R1)  |             | 3                         |            | 5                         |
| 5.2pF(5R2)  |             | 3                         |            | 5                         |
| 5.3pF(5R3)  |             | 3                         |            | 5                         |
| 5.4pF(5R4)  |             | 3                         |            | 5                         |
| 5.5pF(5R5)  |             | 3                         |            | 5                         |
| 5.6pF(5R6)  |             | 3                         |            | 5                         |
| 5.7pF(5R7)  |             | 3                         |            | 5                         |
| 5.8pF(5R8)  |             | 3                         |            | 5                         |
| 5.9pF(5R9)  |             | 3                         |            | 5                         |
| 6.0pF(6R0)  |             | 3                         |            | 5                         |
| 6.1pF(6R1)  |             | 3                         |            | 5                         |
| 6.2pF(6R2)  |             | 3                         |            | 5                         |
| 6.3pF(6R3)  |             | 3                         |            | 5                         |
| 6.4pF(6R4)  |             | 3                         |            | 5                         |
| 6.5pF(6R5)  |             | 3                         |            | 5                         |
| 6.6pF(6R6)  |             | 3                         |            | 5                         |
| 6.7pF(6R7)  |             | 3                         |            | 5                         |
| 6.8pF(6R8)  |             | 3                         |            | 5                         |
| 6.9pF(6R9)  |             | 3                         |            | 5                         |
| 7.0pF(7R0)  |             | 3                         |            | 5                         |
| 7.1pF(7R1)  |             | 3                         |            | 5                         |
| 7.2pF(7R2)  |             | 3                         |            | 5                         |
| 7.3pF(7R3)  |             | 3                         |            | 5                         |
| 7.4pF(7R4)  |             | 3                         |            | 5                         |
| 7.5pF(7R5)  |             | 3                         |            | 5                         |
| 7.6pF(7R6)  |             | 3                         |            | 5                         |
| 7.7pF(7R7)  |             | 3                         |            | 5                         |
| 7.8pF(7R8)  |             | 3                         |            | 5                         |
| 7.9pF(7R9)  |             | 3                         |            | 5                         |
| 8.0pF(8R0)  |             | 3                         |            | 5                         |
| 8.1pF(8R1)  |             | 3                         |            | 5                         |
| 8.2pF(8R2)  |             | 3                         |            | 5                         |
| 8.3pF(8R3)  |             | 3                         |            | 5                         |
| 8.4pF(8R4)  |             | 3                         |            | 5                         |
| 8.5pF(8R5)  |             | 3                         |            | 5                         |
| 8.6pF(8R6)  |             | 3                         |            | 5                         |
| 8.7pF(8R7)  |             | 3                         |            | 5                         |
| 8.8pF(8R8)  |             | 3                         |            | 5                         |
| 8.9pF(8R9)  |             | 3                         |            | 5                         |
| 9.0pF(9R0)  |             | 3                         |            | 5                         |
| 9.1pF(9R1)  |             | 3                         |            | 5                         |
| 9.2pF(9R2)  |             | 3                         |            | 5                         |
| 9.3pF(9R3)  |             | 3                         |            | 5                         |
| 9.4pF(9R4)  |             | 3                         |            | 5                         |
| 9.5pF(9R5)  |             | 3                         |            | 5                         |
| 9.6pF(9R6)  |             | 3                         |            | 5                         |
| 9.7pF(9R7)  |             | 3                         |            | 5                         |
| 9.8pF(9R8)  |             | 3                         |            | 5                         |

| Capacitance | LxW<br>[mm] | 0.6x0.3<br>(03)<br><0201> |            | 1.0x0.5<br>(15)<br><0402> |
|-------------|-------------|---------------------------|------------|---------------------------|
|             |             | Rated Voltage<br>[Vdc]    | 25<br>(1A) | 6.3<br>(0J)               |
| 9.9pF(9R9)  |             | 3                         |            | 5                         |
| 10pF(100)   |             | 3                         |            | 5                         |
| 11pF(110)   |             | 3                         |            | 5                         |
| 12pF(120)   |             | 3                         |            | 5                         |
| 13pF(130)   |             | 3                         |            | 5                         |
| 15pF(150)   |             | 3                         |            | 5                         |
| 16pF(160)   |             | 3                         |            | 5                         |
| 18pF(180)   |             | 3                         |            | 5                         |
| 20pF(200)   |             | 3                         |            | 5                         |
| 22pF(220)   |             |                           | 3          |                           |
| 24pF(240)   |             |                           | 3          |                           |
| 27pF(270)   |             |                           | 3          |                           |
| 30pF(300)   |             |                           | 3          |                           |
| 33pF(330)   |             |                           | 3          |                           |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 0.1pF(R10)        | ±0.05pF(W) |                    | GJM1555C1HR10WB01D |
|                   | ±0.1pF(B)  |                    | GJM1555C1HR10BB01D |
| 0.2pF(R20)        | ±0.05pF(W) | GJM0335C1ER20WB01D | GJM1555C1HR20WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER20BB01D | GJM1555C1HR20BB01D |
| 0.3pF(R30)        | ±0.05pF(W) | GJM0335C1ER30WB01D | GJM1555C1HR30WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER30BB01D | GJM1555C1HR30BB01D |
| 0.4pF(R40)        | ±0.05pF(W) | GJM0335C1ER40WB01D | GJM1555C1HR40WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER40BB01D | GJM1555C1HR40BB01D |
| 0.5pF(R50)        | ±0.05pF(W) | GJM0335C1ER50WB01D | GJM1555C1HR50WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER50BB01D | GJM1555C1HR50BB01D |
| 0.6pF(R60)        | ±0.05pF(W) | GJM0335C1ER60WB01D | GJM1555C1HR60WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER60BB01D | GJM1555C1HR60BB01D |
| 0.7pF(R70)        | ±0.05pF(W) | GJM0335C1ER70WB01D | GJM1555C1HR70WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER70BB01D | GJM1555C1HR70BB01D |
| 0.8pF(R80)        | ±0.05pF(W) | GJM0335C1ER80WB01D | GJM1555C1HR80WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER80BB01D | GJM1555C1HR80BB01D |
| 0.9pF(R90)        | ±0.05pF(W) | GJM0335C1ER90WB01D | GJM1555C1HR90WB01D |
|                   | ±0.1pF(B)  | GJM0335C1ER90BB01D | GJM1555C1HR90BB01D |
| 1.0pF(1R0)        | ±0.05pF(W) | GJM0335C1E1R0WB01D | GJM1555C1H1R0WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R0BB01D | GJM1555C1H1R0BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R0CB01D | GJM1555C1H1R0CB01D |
| 1.1pF(1R1)        | ±0.05pF(W) | GJM0335C1E1R1WB01D | GJM1555C1H1R1WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R1BB01D | GJM1555C1H1R1BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R1CB01D | GJM1555C1H1R1CB01D |
| 1.2pF(1R2)        | ±0.05pF(W) | GJM0335C1E1R2WB01D | GJM1555C1H1R2WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R2BB01D | GJM1555C1H1R2BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R2CB01D | GJM1555C1H1R2CB01D |
| 1.3pF(1R3)        | ±0.05pF(W) | GJM0335C1E1R3WB01D | GJM1555C1H1R3WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R3BB01D | GJM1555C1H1R3BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R3CB01D | GJM1555C1H1R3CB01D |
| 1.4pF(1R4)        | ±0.05pF(W) | GJM0335C1E1R4WB01D | GJM1555C1H1R4WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R4BB01D | GJM1555C1H1R4BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R4CB01D | GJM1555C1H1R4CB01D |
| 1.5pF(1R5)        | ±0.05pF(W) | GJM0335C1E1R5WB01D | GJM1555C1H1R5WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R5BB01D | GJM1555C1H1R5BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R5CB01D | GJM1555C1H1R5CB01D |
| 1.6pF(1R6)        | ±0.05pF(W) | GJM0335C1E1R6WB01D | GJM1555C1H1R6WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R6BB01D | GJM1555C1H1R6BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R6CB01D | GJM1555C1H1R6CB01D |
| 1.7pF(1R7)        | ±0.05pF(W) | GJM0335C1E1R7WB01D | GJM1555C1H1R7WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R7BB01D | GJM1555C1H1R7BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R7CB01D | GJM1555C1H1R7CB01D |
| 1.8pF(1R8)        | ±0.05pF(W) | GJM0335C1E1R8WB01D | GJM1555C1H1R8WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R8BB01D | GJM1555C1H1R8BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R8CB01D | GJM1555C1H1R8CB01D |
| 1.9pF(1R9)        | ±0.05pF(W) | GJM0335C1E1R9WB01D | GJM1555C1H1R9WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E1R9BB01D | GJM1555C1H1R9BB01D |
|                   | ±0.25pF(C) | GJM0335C1E1R9CB01D | GJM1555C1H1R9CB01D |
| 2.0pF(2R0)        | ±0.05pF(W) | GJM0335C1E2R0WB01D | GJM1555C1H2R0WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R0BB01D | GJM1555C1H2R0BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R0CB01D | GJM1555C1H2R0CB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GJ** **M** **03** **3** **5C** **1E** **R20** **W** **B01** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 2.1pF(2R1)        | ±0.05pF(W) | GJM0335C1E2R1WB01D | GJM1555C1H2R1WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R1BB01D | GJM1555C1H2R1BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R1CB01D | GJM1555C1H2R1CB01D |
| 2.2pF(2R2)        | ±0.05pF(W) | GJM0335C1E2R2WB01D | GJM1555C1H2R2WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R2BB01D | GJM1555C1H2R2BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R2CB01D | GJM1555C1H2R2CB01D |
| 2.3pF(2R3)        | ±0.05pF(W) | GJM0335C1E2R3WB01D | GJM1555C1H2R3WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R3BB01D | GJM1555C1H2R3BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R3CB01D | GJM1555C1H2R3CB01D |
| 2.4pF(2R4)        | ±0.05pF(W) | GJM0335C1E2R4WB01D | GJM1555C1H2R4WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R4BB01D | GJM1555C1H2R4BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R4CB01D | GJM1555C1H2R4CB01D |
| 2.5pF(2R5)        | ±0.05pF(W) | GJM0335C1E2R5WB01D | GJM1555C1H2R5WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R5BB01D | GJM1555C1H2R5BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R5CB01D | GJM1555C1H2R5CB01D |
| 2.6pF(2R6)        | ±0.05pF(W) | GJM0335C1E2R6WB01D | GJM1555C1H2R6WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R6BB01D | GJM1555C1H2R6BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R6CB01D | GJM1555C1H2R6CB01D |
| 2.7pF(2R7)        | ±0.05pF(W) | GJM0335C1E2R7WB01D | GJM1555C1H2R7WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R7BB01D | GJM1555C1H2R7BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R7CB01D | GJM1555C1H2R7CB01D |
| 2.8pF(2R8)        | ±0.05pF(W) | GJM0335C1E2R8WB01D | GJM1555C1H2R8WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R8BB01D | GJM1555C1H2R8BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R8CB01D | GJM1555C1H2R8CB01D |
| 2.9pF(2R9)        | ±0.05pF(W) | GJM0335C1E2R9WB01D | GJM1555C1H2R9WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E2R9BB01D | GJM1555C1H2R9BB01D |
|                   | ±0.25pF(C) | GJM0335C1E2R9CB01D | GJM1555C1H2R9CB01D |
| 3.0pF(3R0)        | ±0.05pF(W) | GJM0335C1E3R0WB01D | GJM1555C1H3R0WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R0BB01D | GJM1555C1H3R0BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R0CB01D | GJM1555C1H3R0CB01D |
| 3.1pF(3R1)        | ±0.05pF(W) | GJM0335C1E3R1WB01D | GJM1555C1H3R1WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R1BB01D | GJM1555C1H3R1BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R1CB01D | GJM1555C1H3R1CB01D |
| 3.2pF(3R2)        | ±0.05pF(W) | GJM0335C1E3R2WB01D | GJM1555C1H3R2WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R2BB01D | GJM1555C1H3R2BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R2CB01D | GJM1555C1H3R2CB01D |
| 3.3pF(3R3)        | ±0.05pF(W) | GJM0335C1E3R3WB01D | GJM1555C1H3R3WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R3BB01D | GJM1555C1H3R3BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R3CB01D | GJM1555C1H3R3CB01D |
| 3.4pF(3R4)        | ±0.05pF(W) | GJM0335C1E3R4WB01D | GJM1555C1H3R4WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R4BB01D | GJM1555C1H3R4BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R4CB01D | GJM1555C1H3R4CB01D |
| 3.5pF(3R5)        | ±0.05pF(W) | GJM0335C1E3R5WB01D | GJM1555C1H3R5WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R5BB01D | GJM1555C1H3R5BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R5CB01D | GJM1555C1H3R5CB01D |
| 3.6pF(3R6)        | ±0.05pF(W) | GJM0335C1E3R6WB01D | GJM1555C1H3R6WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R6BB01D | GJM1555C1H3R6BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R6CB01D | GJM1555C1H3R6CB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GJ** **M** **03** **3** **5C** **1E** **2R1** **W** **B01** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 3.7pF(3R7)        | ±0.05pF(W) | GJM0335C1E3R7WB01D | GJM1555C1H3R7WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R7BB01D | GJM1555C1H3R7BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R7CB01D | GJM1555C1H3R7CB01D |
| 3.8pF(3R8)        | ±0.05pF(W) | GJM0335C1E3R8WB01D | GJM1555C1H3R8WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R8BB01D | GJM1555C1H3R8BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R8CB01D | GJM1555C1H3R8CB01D |
| 3.9pF(3R9)        | ±0.05pF(W) | GJM0335C1E3R9WB01D | GJM1555C1H3R9WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E3R9BB01D | GJM1555C1H3R9BB01D |
|                   | ±0.25pF(C) | GJM0335C1E3R9CB01D | GJM1555C1H3R9CB01D |
| 4.0pF(4R0)        | ±0.05pF(W) | GJM0335C1E4R0WB01D | GJM1555C1H4R0WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R0BB01D | GJM1555C1H4R0BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R0CB01D | GJM1555C1H4R0CB01D |
| 4.1pF(4R1)        | ±0.05pF(W) | GJM0335C1E4R1WB01D | GJM1555C1H4R1WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R1BB01D | GJM1555C1H4R1BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R1CB01D | GJM1555C1H4R1CB01D |
| 4.2pF(4R2)        | ±0.05pF(W) | GJM0335C1E4R2WB01D | GJM1555C1H4R2WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R2BB01D | GJM1555C1H4R2BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R2CB01D | GJM1555C1H4R2CB01D |
| 4.3pF(4R3)        | ±0.05pF(W) | GJM0335C1E4R3WB01D | GJM1555C1H4R3WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R3BB01D | GJM1555C1H4R3BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R3CB01D | GJM1555C1H4R3CB01D |
| 4.4pF(4R4)        | ±0.05pF(W) | GJM0335C1E4R4WB01D | GJM1555C1H4R4WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R4BB01D | GJM1555C1H4R4BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R4CB01D | GJM1555C1H4R4CB01D |
| 4.5pF(4R5)        | ±0.05pF(W) | GJM0335C1E4R5WB01D | GJM1555C1H4R5WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R5BB01D | GJM1555C1H4R5BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R5CB01D | GJM1555C1H4R5CB01D |
| 4.6pF(4R6)        | ±0.05pF(W) | GJM0335C1E4R6WB01D | GJM1555C1H4R6WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R6BB01D | GJM1555C1H4R6BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R6CB01D | GJM1555C1H4R6CB01D |
| 4.7pF(4R7)        | ±0.05pF(W) | GJM0335C1E4R7WB01D | GJM1555C1H4R7WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R7BB01D | GJM1555C1H4R7BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R7CB01D | GJM1555C1H4R7CB01D |
| 4.8pF(4R8)        | ±0.05pF(W) | GJM0335C1E4R8WB01D | GJM1555C1H4R8WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R8BB01D | GJM1555C1H4R8BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R8CB01D | GJM1555C1H4R8CB01D |
| 4.9pF(4R9)        | ±0.05pF(W) | GJM0335C1E4R9WB01D | GJM1555C1H4R9WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E4R9BB01D | GJM1555C1H4R9BB01D |
|                   | ±0.25pF(C) | GJM0335C1E4R9CB01D | GJM1555C1H4R9CB01D |
| 5.0pF(5R0)        | ±0.05pF(W) | GJM0335C1E5R0WB01D | GJM1555C1H5R0WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E5R0BB01D | GJM1555C1H5R0BB01D |
|                   | ±0.25pF(C) | GJM0335C1E5R0CB01D | GJM1555C1H5R0CB01D |
| 5.1pF(5R1)        | ±0.05pF(W) | GJM0335C1E5R1WB01D | GJM1555C1H5R1WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E5R1BB01D | GJM1555C1H5R1BB01D |
|                   | ±0.25pF(C) | GJM0335C1E5R1CB01D | GJM1555C1H5R1CB01D |
|                   | ±0.5pF(D)  | GJM0335C1E5R1DB01D | GJM1555C1H5R1DB01D |
| 5.2pF(5R2)        | ±0.05pF(W) | GJM0335C1E5R2WB01D | GJM1555C1H5R2WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E5R2BB01D | GJM1555C1H5R2BB01D |
|                   | ±0.25pF(C) | GJM0335C1E5R2CB01D | GJM1555C1H5R2CB01D |
|                   | ±0.5pF(D)  | GJM0335C1E5R2DB01D | GJM1555C1H5R2DB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## 4

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

- ④ Dimension (T)
- ⑦ Capacitance
- ⑩ Packaging

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## Temperature Compensating Type C0G(5C)/C0H(6C) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 6.5pF(6R5)        | ±0.05pF(W) | GJM0335C1E6R5WB01D | GJM1555C1H6R5WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E6R5BB01D | GJM1555C1H6R5BB01D |
|                   | ±0.25pF(C) | GJM0335C1E6R5CB01D | GJM1555C1H6R5CB01D |
|                   | ±0.5pF(D)  | GJM0335C1E6R5DB01D | GJM1555C1H6R5DB01D |
| 6.6pF(6R6)        | ±0.05pF(W) | GJM0335C1E6R6WB01D | GJM1555C1H6R6WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E6R6BB01D | GJM1555C1H6R6BB01D |
|                   | ±0.25pF(C) | GJM0335C1E6R6CB01D | GJM1555C1H6R6CB01D |
|                   | ±0.5pF(D)  | GJM0335C1E6R6DB01D | GJM1555C1H6R6DB01D |
| 6.7pF(6R7)        | ±0.05pF(W) | GJM0335C1E6R7WB01D | GJM1555C1H6R7WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E6R7BB01D | GJM1555C1H6R7BB01D |
|                   | ±0.25pF(C) | GJM0335C1E6R7CB01D | GJM1555C1H6R7CB01D |
|                   | ±0.5pF(D)  | GJM0335C1E6R7DB01D | GJM1555C1H6R7DB01D |
| 6.8pF(6R8)        | ±0.05pF(W) | GJM0335C1E6R8WB01D | GJM1555C1H6R8WB01D |
|                   | ±0.1pF(B)  | GJM0335C1E6R8BB01D | GJM1555C1H6R8BB01D |
|                   | ±0.25pF(C) | GJM0335C1E6R8CB01D | GJM1555C1H6R8CB01D |
|                   | ±0.5pF(D)  | GJM0335C1E6R8DB01D | GJM1555C1H6R8DB01D |
| 6.9pF(6R9)        | ±0.05pF(W) | GJM0336C1E6R9WB01D | GJM1555C1H6R9WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E6R9BB01D | GJM1555C1H6R9BB01D |
|                   | ±0.25pF(C) | GJM0336C1E6R9CB01D | GJM1555C1H6R9CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E6R9DB01D | GJM1555C1H6R9DB01D |
| 7.0pF(7R0)        | ±0.05pF(W) | GJM0336C1E7R0WB01D | GJM1555C1H7R0WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R0BB01D | GJM1555C1H7R0BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R0CB01D | GJM1555C1H7R0CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R0DB01D | GJM1555C1H7R0DB01D |
| 7.1pF(7R1)        | ±0.05pF(W) | GJM0336C1E7R1WB01D | GJM1555C1H7R1WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R1BB01D | GJM1555C1H7R1BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R1CB01D | GJM1555C1H7R1CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R1DB01D | GJM1555C1H7R1DB01D |
| 7.2pF(7R2)        | ±0.05pF(W) | GJM0336C1E7R2WB01D | GJM1555C1H7R2WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R2BB01D | GJM1555C1H7R2BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R2CB01D | GJM1555C1H7R2CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R2DB01D | GJM1555C1H7R2DB01D |
| 7.3pF(7R3)        | ±0.05pF(W) | GJM0336C1E7R3WB01D | GJM1555C1H7R3WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R3BB01D | GJM1555C1H7R3BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R3CB01D | GJM1555C1H7R3CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R3DB01D | GJM1555C1H7R3DB01D |
| 7.4pF(7R4)        | ±0.05pF(W) | GJM0336C1E7R4WB01D | GJM1555C1H7R4WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R4BB01D | GJM1555C1H7R4BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R4CB01D | GJM1555C1H7R4CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R4DB01D | GJM1555C1H7R4DB01D |
| 7.5pF(7R5)        | ±0.05pF(W) | GJM0336C1E7R5WB01D | GJM1555C1H7R5WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R5BB01D | GJM1555C1H7R5BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R5CB01D | GJM1555C1H7R5CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R5DB01D | GJM1555C1H7R5DB01D |
| 7.6pF(7R6)        | ±0.05pF(W) | GJM0336C1E7R6WB01D | GJM1555C1H7R6WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R6BB01D | GJM1555C1H7R6BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R6CB01D | GJM1555C1H7R6CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R6DB01D | GJM1555C1H7R6DB01D |
| 7.7pF(7R7)        | ±0.05pF(W) | GJM0336C1E7R7WB01D | GJM1555C1H7R7WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R7BB01D | GJM1555C1H7R7BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R7CB01D | GJM1555C1H7R7CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R7DB01D | GJM1555C1H7R7DB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

## Temperature Compensating Type C0G(5C)/C0H(6C) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 7.8pF(7R8)        | ±0.05pF(W) | GJM0336C1E7R8WB01D | GJM1555C1H7R8WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R8BB01D | GJM1555C1H7R8BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R8CB01D | GJM1555C1H7R8CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R8DB01D | GJM1555C1H7R8DB01D |
| 7.9pF(7R9)        | ±0.05pF(W) | GJM0336C1E7R9WB01D | GJM1555C1H7R9WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E7R9BB01D | GJM1555C1H7R9BB01D |
|                   | ±0.25pF(C) | GJM0336C1E7R9CB01D | GJM1555C1H7R9CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E7R9DB01D | GJM1555C1H7R9DB01D |
| 8.0pF(8R0)        | ±0.05pF(W) | GJM0336C1E8R0WB01D | GJM1555C1H8R0WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R0BB01D | GJM1555C1H8R0BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R0CB01D | GJM1555C1H8R0CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R0DB01D | GJM1555C1H8R0DB01D |
| 8.1pF(8R1)        | ±0.05pF(W) | GJM0336C1E8R1WB01D | GJM1555C1H8R1WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R1BB01D | GJM1555C1H8R1BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R1CB01D | GJM1555C1H8R1CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R1DB01D | GJM1555C1H8R1DB01D |
| 8.2pF(8R2)        | ±0.05pF(W) | GJM0336C1E8R2WB01D | GJM1555C1H8R2WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R2BB01D | GJM1555C1H8R2BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R2CB01D | GJM1555C1H8R2CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R2DB01D | GJM1555C1H8R2DB01D |
| 8.3pF(8R3)        | ±0.05pF(W) | GJM0336C1E8R3WB01D | GJM1555C1H8R3WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R3BB01D | GJM1555C1H8R3BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R3CB01D | GJM1555C1H8R3CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R3DB01D | GJM1555C1H8R3DB01D |
| 8.4pF(8R4)        | ±0.05pF(W) | GJM0336C1E8R4WB01D | GJM1555C1H8R4WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R4BB01D | GJM1555C1H8R4BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R4CB01D | GJM1555C1H8R4CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R4DB01D | GJM1555C1H8R4DB01D |
| 8.5pF(8R5)        | ±0.05pF(W) | GJM0336C1E8R5WB01D | GJM1555C1H8R5WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R5BB01D | GJM1555C1H8R5BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R5CB01D | GJM1555C1H8R5CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R5DB01D | GJM1555C1H8R5DB01D |
| 8.6pF(8R6)        | ±0.05pF(W) | GJM0336C1E8R6WB01D | GJM1555C1H8R6WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R6BB01D | GJM1555C1H8R6BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R6CB01D | GJM1555C1H8R6CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R6DB01D | GJM1555C1H8R6DB01D |
| 8.7pF(8R7)        | ±0.05pF(W) | GJM0336C1E8R7WB01D | GJM1555C1H8R7WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R7BB01D | GJM1555C1H8R7BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R7CB01D | GJM1555C1H8R7CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R7DB01D | GJM1555C1H8R7DB01D |
| 8.8pF(8R8)        | ±0.05pF(W) | GJM0336C1E8R8WB01D | GJM1555C1H8R8WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R8BB01D | GJM1555C1H8R8BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R8CB01D | GJM1555C1H8R8CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R8DB01D | GJM1555C1H8R8DB01D |
| 8.9pF(8R9)        | ±0.05pF(W) | GJM0336C1E8R9WB01D | GJM1555C1H8R9WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E8R9BB01D | GJM1555C1H8R9BB01D |
|                   | ±0.25pF(C) | GJM0336C1E8R9CB01D | GJM1555C1H8R9CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E8R9DB01D | GJM1555C1H8R9DB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GJ** **M** **03** **3** **6C** **1E** **7R8** **W** **B01** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C)/C0H(6C) Characteristics

| LxW [mm]          |            | 0.6x0.3(03)<0201>  | 1.0x0.5(15)<0402>  |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 25(1E)             | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |
| 9.0pF(9R0)        | ±0.05pF(W) | GJM0336C1E9R0WB01D | GJM1555C1H9R0WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R0BB01D | GJM1555C1H9R0BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R0CB01D | GJM1555C1H9R0CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R0DB01D | GJM1555C1H9R0DB01D |
| 9.1pF(9R1)        | ±0.05pF(W) | GJM0336C1E9R1WB01D | GJM1555C1H9R1WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R1BB01D | GJM1555C1H9R1BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R1CB01D | GJM1555C1H9R1CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R1DB01D | GJM1555C1H9R1DB01D |
| 9.2pF(9R2)        | ±0.05pF(W) | GJM0336C1E9R2WB01D | GJM1555C1H9R2WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R2BB01D | GJM1555C1H9R2BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R2CB01D | GJM1555C1H9R2CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R2DB01D | GJM1555C1H9R2DB01D |
| 9.3pF(9R3)        | ±0.05pF(W) | GJM0336C1E9R3WB01D | GJM1555C1H9R3WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R3BB01D | GJM1555C1H9R3BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R3CB01D | GJM1555C1H9R3CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R3DB01D | GJM1555C1H9R3DB01D |
| 9.4pF(9R4)        | ±0.05pF(W) | GJM0336C1E9R4WB01D | GJM1555C1H9R4WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R4BB01D | GJM1555C1H9R4BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R4CB01D | GJM1555C1H9R4CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R4DB01D | GJM1555C1H9R4DB01D |
| 9.5pF(9R5)        | ±0.05pF(W) | GJM0336C1E9R5WB01D | GJM1555C1H9R5WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R5BB01D | GJM1555C1H9R5BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R5CB01D | GJM1555C1H9R5CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R5DB01D | GJM1555C1H9R5DB01D |
| 9.6pF(9R6)        | ±0.05pF(W) | GJM0336C1E9R6WB01D | GJM1555C1H9R6WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R6BB01D | GJM1555C1H9R6BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R6CB01D | GJM1555C1H9R6CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R6DB01D | GJM1555C1H9R6DB01D |
| 9.7pF(9R7)        | ±0.05pF(W) | GJM0336C1E9R7WB01D | GJM1555C1H9R7WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R7BB01D | GJM1555C1H9R7BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R7CB01D | GJM1555C1H9R7CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R7DB01D | GJM1555C1H9R7DB01D |
| 9.8pF(9R8)        | ±0.05pF(W) | GJM0336C1E9R8WB01D | GJM1555C1H9R8WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R8BB01D | GJM1555C1H9R8BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R8CB01D | GJM1555C1H9R8CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R8DB01D | GJM1555C1H9R8DB01D |
| 9.9pF(9R9)        | ±0.05pF(W) | GJM0336C1E9R9WB01D | GJM1555C1H9R9WB01D |
|                   | ±0.1pF(B)  | GJM0336C1E9R9BB01D | GJM1555C1H9R9BB01D |
|                   | ±0.25pF(C) | GJM0336C1E9R9CB01D | GJM1555C1H9R9CB01D |
|                   | ±0.5pF(D)  | GJM0336C1E9R9DB01D | GJM1555C1H9R9DB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## 4

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

- ④ Dimension (T)
- ⑦ Capacitance
- ⑩ Packaging

***muRata***

## GJM Series Specifications and Test Methods

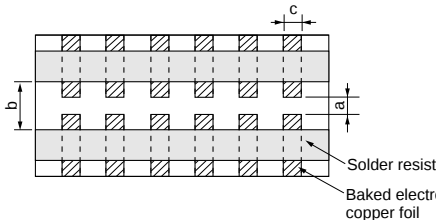
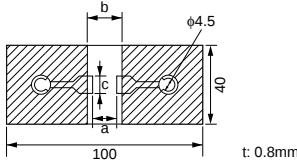
| No.       | Item                                    |                         | Specifications                                                                                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
|-----------|-----------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------|--------------|--------------------|-----|-------|-----|--------------------|-----|-------|-----|
|           |                                         |                         | Temperature Compensating Type                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 1         | Operating Temperature Range             |                         | −55 to +125°C                                                                                     | Reference Temperature: 25°C<br>(2C, 3C, 4C: 20°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 2         | Rated Voltage                           |                         | See the previous pages.                                                                           | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 3         | Appearance                              |                         | No defects or abnormalities                                                                       | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 4         | Dimensions                              |                         | Within the specified dimensions                                                                   | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 5         | Dielectric Strength                     |                         | No defects or abnormalities                                                                       | No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 6         | Insulation Resistance (I.R.)            |                         | 10,000MΩ min. or 500Ω · F min. (Whichever is smaller)                                             | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 7         | Capacitance                             |                         | Within the specified tolerance                                                                    | The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 8         | Q                                       |                         | 30pF and over: $Q \geq 1000$<br>30pF and below: $Q \geq 400 + 20C$<br>C: Nominal Capacitance (pF) | <table><tr><td>Frequency</td><td>1±0.1MHz</td></tr><tr><td>Voltage</td><td>0.5 to 5Vrms</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Frequency                                                                                                                                                                                                                                                                  | 1±0.1MHz | Voltage          | 0.5 to 5Vrms |                    |     |       |     |                    |     |       |     |
| Frequency | 1±0.1MHz                                |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| Voltage   | 0.5 to 5Vrms                            |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 9         | Capacitance Temperature Characteristics | Temperature Coefficient | Within the specified tolerance (Table A)                                                          | The capacitance change should be measured after 5 min. at each specified temperature stage.<br>Temperature Compensating Type<br>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.<br>When cycling the temperature sequentially from step 1 through 5, (5C: +25 to 125°C; other temp. coeffs.: +20 to 125°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.                                                                                |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
|           |                                         | Capacitance Drift       | Within ±0.2% or ±0.05pF (Whichever is larger.)                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>Reference Temp. ±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>Reference Temp. ±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>Reference Temp. ±2</td></tr></table> | Step     | Temperature (°C) | 1            | Reference Temp. ±2 | 2   | −55±3 | 3   | Reference Temp. ±2 | 4   | 125±3 | 5   |
| Step      | Temperature (°C)                        |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 1         | Reference Temp. ±2                      |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 2         | −55±3                                   |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 3         | Reference Temp. ±2                      |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 4         | 125±3                                   |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 5         | Reference Temp. ±2                      |                         |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| 10        | Adhesive Strength of Termination        |                         | No removal of the terminations or other defect should occur.                                      | <p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply a 5N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p style="text-align: right;">*2N (GJM03)</p> <div><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GJM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GJM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr></table><p style="text-align: right;">(in mm)</p></div> | Type                                                                                                                                                                                                                                                                       | a        | b                | c            | GJM03              | 0.3 | 0.9   | 0.3 | GJM15              | 0.4 | 1.5   | 0.5 |
| Type      | a                                       | b                       | c                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| GJM03     | 0.3                                     | 0.9                     | 0.3                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |
| GJM15     | 0.4                                     | 1.5                     | 0.5                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            |          |                  |              |                    |     |       |     |                    |     |       |     |

Fig. 1

Continued on the following page. 

## GJM Series Specifications and Test Methods

Continued from the preceding page.

| No.   | Item                         | Specifications                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                 | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |   |   |   |       |     |     |     |       |
|-------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|-------|-----|-----|-----|-------|
|       |                              | Temperature Compensating Type                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| 11    | Vibration Resistance         | Appearance                                                                                                                                                                                                                                                                                                                        | No defects or abnormalities                                                                                                                                     | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |      |   |   |   |       |     |     |     |       |
|       |                              | Capacitance                                                                                                                                                                                                                                                                                                                       | Within the specified tolerance                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Q                                                                                                                                                                                                                                                                                                                                 | 30pF and over: $Q \geq 1000$<br>30pF and below: $Q \geq 400 + 20C$<br>C: Nominal Capacitance (pF)                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| 12    | Deflection                   | Appearance                                                                                                                                                                                                                                                                                                                        | No marking defects                                                                                                                                              | Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.                                                                                                                                                                                                                     |      |   |   |   |       |     |     |     |       |
|       |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | <div><table><thead><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr></thead><tbody><tr><td>GJM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GJM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr></tbody></table><p>(in mm)</p></div> |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Type | a | b | c | GJM03 | 0.3 | 0.9 | 0.3 | GJM15 |
| Type  | a                            | b                                                                                                                                                                                                                                                                                                                                 | c                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| GJM03 | 0.3                          | 0.9                                                                                                                                                                                                                                                                                                                               | 0.3                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| GJM15 | 0.4                          | 1.5                                                                                                                                                                                                                                                                                                                               | 0.5                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| 13    | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                               |                                                                                                                                                                 | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for $2 \pm 0.5$ seconds at $230 \pm 5^\circ\text{C}$ or Sn-3.0Ag-0.5Cu solder solution for $2 \pm 0.5$ seconds at $245 \pm 5^\circ\text{C}$ .                                                                                                                                                                    |      |   |   |   |       |     |     |     |       |
| 14    | Resistance to Soldering Heat | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                               |                                                                                                                                                                 | Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at $270 \pm 5^\circ\text{C}$ for $10 \pm 0.5$ seconds. Let sit at room temperature for $24 \pm 2$ hours.                                                                                                                                                                                                                                                                                                |      |   |   |   |       |     |     |     |       |
|       |                              | Appearance                                                                                                                                                                                                                                                                                                                        | No marking defects                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Q                                                                                                                                                                                                                                                                                                                                 | 30pF and over: $Q \geq 1000$<br>30pF and below: $Q \geq 400 + 20C$<br>C: Nominal Capacitance (pF)                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | I.R.                                                                                                                                                                                                                                                                                                                              | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| 15    | Temperature Cycle            | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                               |                                                                                                                                                                 | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for $24 \pm 2$ hours at room temperature, then measure.                                                                                                                                                                                                                                                                           |      |   |   |   |       |     |     |     |       |
|       |                              | Appearance                                                                                                                                                                                                                                                                                                                        | No marking defects                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Q                                                                                                                                                                                                                                                                                                                                 | 30pF and over: $Q \geq 1000$<br>30pF and below: $Q \geq 400 + 20C$<br>C: Nominal Capacitance (pF)                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | I.R.                                                                                                                                                                                                                                                                                                                              | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
| 16    | Humidity, Steady State       | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                               |                                                                                                                                                                 | Let the capacitor sit at $40 \pm 2^\circ\text{C}$ and 90 to 95% humidity for $500 \pm 12$ hours. Remove and let sit for $24 \pm 2$ hours (temperature compensating type) at room temperature, then measure.                                                                                                                                                                                                                                                                                                                              |      |   |   |   |       |     |     |     |       |
|       |                              | Appearance                                                                                                                                                                                                                                                                                                                        | No marking defects                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | Q                                                                                                                                                                                                                                                                                                                                 | 30pF and below: $Q \geq 350$<br>10pF and over, 30pF and below: $Q \geq 275 + \frac{1}{2}C$<br>10pF and below: $Q \geq 200 + 10C$<br>C: Nominal Capacitance (pF) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |
|       |                              | I.R.                                                                                                                                                                                                                                                                                                                              | More than 10,000MΩ or 500Ω · F (Whichever is smaller)                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |       |     |     |     |       |

Continued on the following page.

## GJM Series Specifications and Test Methods

Continued from the preceding page.

| No. | Item                  | Specifications                                                                     |                                                                                                                                                                | Test Method                                                                                                                                                                                                                              |
|-----|-----------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                       | Temperature Compensating Type                                                      |                                                                                                                                                                |                                                                                                                                                                                                                                          |
| 17  | Humidity Load         |                                                                                    | The measured and observed characteristics should satisfy the specifications in the following table.                                                            | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.                                        |
|     |                       | Appearance                                                                         | No marking defects                                                                                                                                             |                                                                                                                                                                                                                                          |
|     |                       | Capacitance Change                                                                 | Within ±7.5% or ±0.75pF<br>(Whichever is larger)                                                                                                               |                                                                                                                                                                                                                                          |
|     |                       | Q                                                                                  | 30pF and over: $Q \geq 200$<br>30pF and below: $Q \geq 100 + \frac{1}{5}C$<br>C: Nominal Capacitance (pF)                                                      |                                                                                                                                                                                                                                          |
|     |                       | I.R.                                                                               | More than 500MΩ or 25Ω · F (Whichever is smaller)                                                                                                              |                                                                                                                                                                                                                                          |
| 18  | High Temperature Load |                                                                                    | The measured and observed characteristics should satisfy the specifications in the following table.                                                            | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.<br>The charge/discharge current is less than 50mA. |
|     |                       | Appearance                                                                         | No marking defects                                                                                                                                             |                                                                                                                                                                                                                                          |
|     |                       | Capacitance Change                                                                 | Within ±3% or ±0.3pF<br>(Whichever is larger)                                                                                                                  |                                                                                                                                                                                                                                          |
|     |                       | Q                                                                                  | 30pF and over: $Q \geq 350$<br>10pF and over, 30pF and below: $Q \geq 275 + \frac{1}{5}C$<br>10pF and below: $Q \geq 200 + 10C$<br>C: Nominal Capacitance (pF) |                                                                                                                                                                                                                                          |
|     |                       | I.R.                                                                               | More than 1,000MΩ or 50Ω · F (Whichever is smaller)                                                                                                            |                                                                                                                                                                                                                                          |
| 19  | ESR                   | 0.1pF≤C≤1pF: 350mΩ · pF below<br>1pF<C≤5pF: 300mΩ below<br>5pF<C≤10pF: 250mΩ below |                                                                                                                                                                | The ESR should be measured at room temperature, and frequency 1±0.2GHz with the equivalent of BOONTON Model 34A.                                                                                                                         |
|     |                       | 10pF<C≤33pF: 400mΩ below                                                           |                                                                                                                                                                | The ESR should be measured at room temperature, and frequency 500±50MHz with the equivalent of HP8753B.                                                                                                                                  |

Table A

(1)

| Char. Code | Temp. Coeff.<br>(ppm/°C) *1 | Capacitance Change from 25°C Value (%) |       |       |       |       |       |
|------------|-----------------------------|----------------------------------------|-------|-------|-------|-------|-------|
|            |                             | -55°C                                  |       | -30°C |       | -10°C |       |
|            |                             | Max.                                   | Min.  | Max.  | Min.  | Max.  | Min.  |
| 5C         | 0±30                        | 0.58                                   | -0.24 | 0.40  | -0.17 | 0.25  | -0.11 |
| 6C         | 0±60                        | 0.87                                   | -0.48 | 0.60  | -0.33 | 0.38  | -0.21 |

\*1: Nominal values denote the temperature coefficient within a range of 25 to 125°C.

(2)

| Char. | Nominal Values<br>(ppm/°C) *2 | Capacitance Change from 20°C Value (%) |       |       |       |       |       |
|-------|-------------------------------|----------------------------------------|-------|-------|-------|-------|-------|
|       |                               | -55°C                                  |       | -25°C |       | -10°C |       |
|       |                               | Max.                                   | Min.  | Max.  | Min.  | Max.  | Min.  |
| 2C    | 0±60                          | 0.82                                   | -0.45 | 0.49  | -0.27 | 0.33  | -0.18 |
| 3C    | 0±120                         | 1.37                                   | -0.90 | 0.82  | -0.54 | 0.55  | -0.36 |
| 4C    | 0±250                         | 2.56                                   | -1.88 | 1.54  | -1.13 | 1.02  | -0.75 |

\*2: Nominal values denote the temperature coefficient within a range of 20 to 125°C.

# Chip Monolithic Ceramic Capacitors



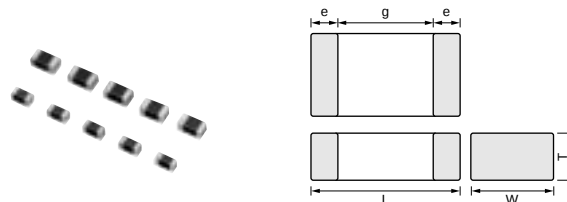
## High Frequency GQM Series

### ■ Features

1. HiQ and low ESR at VHF, UHF, Microwave
2. Feature improvement, low power consumption for mobile telecommunication. (Base station, terminal, etc.)

### ■ Applications

High frequency circuit (Mobile telecommunication, etc.)



| Part Number             | Dimensions (mm) |            |            |            |        |
|-------------------------|-----------------|------------|------------|------------|--------|
|                         | L               | W          | T          | e          | g min. |
| <b>GQM187</b>           | 1.6 ±0.15       | 0.8 ±0.15  | 0.7 ±0.1   | 0.2 to 0.5 | 0.5    |
| <b>GQM188</b>           | 1.6 ±0.1        | 0.8 ±0.1   | 0.8 ±0.1   | 0.2 to 0.5 | 0.5    |
| <b>GQM219</b> (50,100V) | 2.0 ±0.1        | 1.25 ±0.1  | 0.85 ±0.1  | 0.2 to 0.7 | 0.7    |
| <b>GQM219</b> (250V)    | 2.0 ±0.15       | 1.25 ±0.15 | 0.85 ±0.15 | 0.2 to 0.7 | 0.7    |

## Capacitance Table

### Temperature Compensating Type C0G(5C) Characteristics

| 7           |    | ex. 7: T Dimension [mm] |                           |             |             |                            |             |             |
|-------------|----|-------------------------|---------------------------|-------------|-------------|----------------------------|-------------|-------------|
| Capacitance | TC | LxW<br>[mm]             | C0G(5C)                   |             |             |                            |             |             |
|             |    |                         | 1.6x0.8<br>(18)<br><0603> |             |             | 2.0x1.25<br>(21)<br><0805> |             |             |
|             |    |                         | Rated Voltage<br>[Vdc]    | 250<br>(2E) | 100<br>(2A) | 50<br>(1H)                 | 250<br>(2E) | 100<br>(2A) |
| 0.10pF(R10) | 7  |                         |                           |             |             |                            |             |             |
| 0.20pF(R20) | 7  |                         |                           |             |             |                            |             |             |
| 0.30pF(R30) | 7  |                         |                           |             |             |                            |             |             |
| 0.40pF(R40) | 7  |                         |                           |             |             |                            |             |             |
| 0.50pF(R50) | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 0.75pF(R75) | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.0pF(1R0)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.1pF(1R1)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.2pF(1R2)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.3pF(1R3)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.5pF(1R5)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.6pF(1R6)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 1.8pF(1R8)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 2.0pF(2R0)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 2.2pF(2R2)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 2.4pF(2R4)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 2.7pF(2R7)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 3.0pF(3R0)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 3.3pF(3R3)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 3.6pF(3R6)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 3.9pF(3R9)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 4.0pF(4R0)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 4.3pF(4R3)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 4.7pF(4R7)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 5.0pF(5R0)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 5.1pF(5R1)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 5.6pF(5R6)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 6.0pF(6R0)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 6.2pF(6R2)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 6.8pF(6R8)  | 7  | 8                       |                           |             |             | 9                          | 9           |             |
| 7.0pF(7R0)  | 7  |                         |                           | 8           |             | 9                          | 9           |             |

| Capacitance | TC | LxW<br>[mm] | C0G(5C)                   |             |             |                            |             |
|-------------|----|-------------|---------------------------|-------------|-------------|----------------------------|-------------|
|             |    |             | 1.6x0.8<br>(18)<br><0603> |             |             | 2.0x1.25<br>(21)<br><0805> |             |
|             |    |             | Rated Voltage<br>[Vdc]    | 250<br>(2E) | 100<br>(2A) | 50<br>(1H)                 | 250<br>(2E) |
| 7.5pF(7R5)  | 7  |             |                           | 8           | 9           | 9                          |             |
| 8.0pF(8R0)  | 7  |             |                           | 8           | 9           | 9                          |             |
| 8.2pF(8R2)  | 7  |             |                           | 8           | 9           | 9                          |             |
| 9.0pF(9R0)  | 7  |             |                           | 8           | 9           | 9                          |             |
| 9.1pF(9R1)  | 7  |             |                           | 8           | 9           | 9                          |             |
| 10pF(100)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 11pF(110)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 12pF(120)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 13pF(130)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 15pF(150)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 16pF(160)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 18pF(180)   | 7  |             |                           | 8           | 9           | 9                          |             |
| 20pF(200)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 22pF(220)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 24pF(240)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 27pF(270)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 30pF(300)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 33pF(330)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 36pF(360)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 39pF(390)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 43pF(430)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 47pF(470)   | 7  |             |                           | 8           | 9           |                            | 9           |
| 51pF(510)   |    |             |                           | 8           | 9           |                            | 9           |
| 56pF(560)   |    |             |                           | 8           | 9           |                            | 9           |
| 62pF(620)   |    |             |                           | 8           | 9           |                            | 9           |
| 68pF(680)   |    |             |                           | 8           | 9           |                            | 9           |
| 75pF(750)   |    |             |                           | 8           | 9           |                            | 9           |
| 82pF(820)   |    |             |                           | 8           | 9           |                            | 9           |
| 91pF(910)   |    |             |                           | 8           | 9           |                            | 9           |
| 100pF(101)  |    |             |                           | 8           | 9           |                            | 9           |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 1.6x0.8(18)<0603>  |                    |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 250(2E)            | 100(2A)            |
| Capacitance       | Tolerance  | Part Number        |                    |
| 0.10pF(R10)       | ±0.1pF(B)  | GQM1875C2ER10BB12D |                    |
| 0.20pF(R20)       | ±0.1pF(B)  | GQM1875C2ER20BB12D |                    |
| 0.30pF(R30)       | ±0.1pF(B)  | GQM1875C2ER30BB12D |                    |
|                   | ±0.25pF(C) | GQM1875C2ER30CB12D |                    |
| 0.40pF(R40)       | ±0.1pF(B)  | GQM1875C2ER40BB12D |                    |
|                   | ±0.25pF(C) | GQM1875C2ER40CB12D |                    |
| 0.50pF(R50)       | ±0.1pF(B)  | GQM1875C2ER50BB12D | GQM1885C2AR50BB01D |
|                   | ±0.25pF(C) | GQM1875C2ER50CB12D | GQM1885C2AR50CB01D |
| 0.75pF(R75)       | ±0.1pF(B)  | GQM1875C2ER75BB12D | GQM1885C2AR75BB01D |
|                   | ±0.25pF(C) | GQM1875C2ER75CB12D | GQM1885C2AR75CB01D |
| 1.0pF(1R0)        | ±0.1pF(B)  | GQM1875C2E1R0BB12D | GQM1885C2A1R0BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R0CB12D | GQM1885C2A1R0CB01D |
| 1.1pF(1R1)        | ±0.1pF(B)  | GQM1875C2E1R1BB12D | GQM1885C2A1R1BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R1CB12D | GQM1885C2A1R1CB01D |
| 1.2pF(1R2)        | ±0.1pF(B)  | GQM1875C2E1R2BB12D | GQM1885C2A1R2BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R2CB12D | GQM1885C2A1R2CB01D |
| 1.3pF(1R3)        | ±0.1pF(B)  | GQM1875C2E1R3BB12D | GQM1885C2A1R3BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R3CB12D | GQM1885C2A1R3CB01D |
| 1.5pF(1R5)        | ±0.1pF(B)  | GQM1875C2E1R5BB12D | GQM1885C2A1R5BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R5CB12D | GQM1885C2A1R5CB01D |
| 1.6pF(1R6)        | ±0.1pF(B)  | GQM1875C2E1R6BB12D | GQM1885C2A1R6BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R6CB12D | GQM1885C2A1R6CB01D |
| 1.8pF(1R8)        | ±0.1pF(B)  | GQM1875C2E1R8BB12D | GQM1885C2A1R8BB01D |
|                   | ±0.25pF(C) | GQM1875C2E1R8CB12D | GQM1885C2A1R8CB01D |
| 2.0pF(2R0)        | ±0.1pF(B)  | GQM1875C2E2R0BB12D | GQM1885C2A2R0BB01D |
|                   | ±0.25pF(C) | GQM1875C2E2R0CB12D | GQM1885C2A2R0CB01D |
| 2.2pF(2R2)        | ±0.1pF(B)  | GQM1875C2E2R2BB12D | GQM1885C2A2R2BB01D |
|                   | ±0.25pF(C) | GQM1875C2E2R2CB12D | GQM1885C2A2R2CB01D |
| 2.4pF(2R4)        | ±0.1pF(B)  | GQM1875C2E2R4BB12D | GQM1885C2A2R4BB01D |
|                   | ±0.25pF(C) | GQM1875C2E2R4CB12D | GQM1885C2A2R4CB01D |
| 2.7pF(2R7)        | ±0.1pF(B)  | GQM1875C2E2R7BB12D | GQM1885C2A2R7BB01D |
|                   | ±0.25pF(C) | GQM1875C2E2R7CB12D | GQM1885C2A2R7CB01D |
| 3.0pF(3R0)        | ±0.1pF(B)  | GQM1875C2E3R0BB12D | GQM1885C2A3R0BB01D |
|                   | ±0.25pF(C) | GQM1875C2E3R0CB12D | GQM1885C2A3R0CB01D |
| 3.3pF(3R3)        | ±0.1pF(B)  | GQM1875C2E3R3BB12D | GQM1885C2A3R3BB01D |
|                   | ±0.25pF(C) | GQM1875C2E3R3CB12D | GQM1885C2A3R3CB01D |
| 3.6pF(3R6)        | ±0.1pF(B)  | GQM1875C2E3R6BB12D | GQM1885C2A3R6BB01D |
|                   | ±0.25pF(C) | GQM1875C2E3R6CB12D | GQM1885C2A3R6CB01D |
| 3.9pF(3R9)        | ±0.1pF(B)  | GQM1875C2E3R9BB12D | GQM1885C2A3R9BB01D |
|                   | ±0.25pF(C) | GQM1875C2E3R9CB12D | GQM1885C2A3R9CB01D |
| 4.0pF(4R0)        | ±0.1pF(B)  | GQM1875C2E4R0BB12D | GQM1885C2A4R0BB01D |
|                   | ±0.25pF(C) | GQM1875C2E4R0CB12D | GQM1885C2A4R0CB01D |
| 4.3pF(4R3)        | ±0.1pF(B)  | GQM1875C2E4R3BB12D | GQM1885C2A4R3BB01D |
|                   | ±0.25pF(C) | GQM1875C2E4R3CB12D | GQM1885C2A4R3CB01D |
| 4.7pF(4R7)        | ±0.1pF(B)  | GQM1875C2E4R7BB12D | GQM1885C2A4R7BB01D |
|                   | ±0.25pF(C) | GQM1875C2E4R7CB12D | GQM1885C2A4R7CB01D |
| 5.0pF(5R0)        | ±0.1pF(B)  | GQM1875C2E5R0BB12D | GQM1885C2A5R0BB01D |
|                   | ±0.25pF(C) | GQM1875C2E5R0CB12D | GQM1885C2A5R0CB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GQ** **M** **18** **7** **5C** **2E** **R10** **B** **B12** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 1.6x0.8(18)<0603>  |                    |                    |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 250(2E)            | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 5.1pF(5R1)        | ±0.25pF(C) | GQM1875C2E5R1CB12D | GQM1885C2A5R1CB01D |                    |
|                   | ±0.5pF(D)  | GQM1875C2E5R1DB12D | GQM1885C2A5R1DB01D |                    |
| 5.6pF(5R6)        | ±0.25pF(C) | GQM1875C2E5R6CB12D | GQM1885C2A5R6CB01D |                    |
|                   | ±0.5pF(D)  | GQM1875C2E5R6DB12D | GQM1885C2A5R6DB01D |                    |
| 6.0pF(6R0)        | ±0.25pF(C) | GQM1875C2E6R0CB12D | GQM1885C2A6R0CB01D |                    |
|                   | ±0.5pF(D)  | GQM1875C2E6R0DB12D | GQM1885C2A6R0DB01D |                    |
| 6.2pF(6R2)        | ±0.25pF(C) | GQM1875C2E6R2CB12D | GQM1885C2A6R2CB01D |                    |
|                   | ±0.5pF(D)  | GQM1875C2E6R2DB12D | GQM1885C2A6R2DB01D |                    |
| 6.8pF(6R8)        | ±0.25pF(C) | GQM1875C2E6R8CB12D | GQM1885C2A6R8CB01D |                    |
|                   | ±0.5pF(D)  | GQM1875C2E6R8DB12D | GQM1885C2A6R8DB01D |                    |
| 7.0pF(7R0)        | ±0.25pF(C) | GQM1875C2E7R0CB12D |                    | GQM1885C1H7R0CB01D |
|                   | ±0.5pF(D)  | GQM1875C2E7R0DB12D |                    | GQM1885C1H7R0DB01D |
| 7.5pF(7R5)        | ±0.25pF(C) | GQM1875C2E7R5CB12D |                    | GQM1885C1H7R5CB01D |
|                   | ±0.5pF(D)  | GQM1875C2E7R5DB12D |                    | GQM1885C1H7R5DB01D |
| 8.0pF(8R0)        | ±0.25pF(C) | GQM1875C2E8R0CB12D |                    | GQM1885C1H8R0CB01D |
|                   | ±0.5pF(D)  | GQM1875C2E8R0DB12D |                    | GQM1885C1H8R0DB01D |
| 8.2pF(8R2)        | ±0.25pF(C) | GQM1875C2E8R2CB12D |                    | GQM1885C1H8R2CB01D |
|                   | ±0.5pF(D)  | GQM1875C2E8R2DB12D |                    | GQM1885C1H8R2DB01D |
| 9.0pF(9R0)        | ±0.25pF(C) | GQM1875C2E9R0CB12D |                    | GQM1885C1H9R0CB01D |
|                   | ±0.5pF(D)  | GQM1875C2E9R0DB12D |                    | GQM1885C1H9R0DB01D |
| 9.1pF(9R1)        | ±0.25pF(C) | GQM1875C2E9R1CB12D |                    | GQM1885C1H9R1CB01D |
|                   | ±0.5pF(D)  | GQM1875C2E9R1DB12D |                    | GQM1885C1H9R1DB01D |
| 10pF(100)         | ±2%(G)     | GQM1875C2E100GB12D |                    | GQM1885C1H100GB01D |
|                   | ±5%(J)     | GQM1875C2E100JB12D |                    | GQM1885C1H100JB01D |
| 11pF(110)         | ±2%(G)     | GQM1875C2E110GB12D |                    | GQM1885C1H110GB01D |
|                   | ±5%(J)     | GQM1875C2E110JB12D |                    | GQM1885C1H110JB01D |
| 12pF(120)         | ±2%(G)     | GQM1875C2E120GB12D |                    | GQM1885C1H120GB01D |
|                   | ±5%(J)     | GQM1875C2E120JB12D |                    | GQM1885C1H120JB01D |
| 13pF(130)         | ±2%(G)     | GQM1875C2E130GB12D |                    | GQM1885C1H130GB01D |
|                   | ±5%(J)     | GQM1875C2E130JB12D |                    | GQM1885C1H130JB01D |
| 15pF(150)         | ±2%(G)     | GQM1875C2E150GB12D |                    | GQM1885C1H150GB01D |
|                   | ±5%(J)     | GQM1875C2E150JB12D |                    | GQM1885C1H150JB01D |
| 16pF(160)         | ±2%(G)     | GQM1875C2E160GB12D |                    | GQM1885C1H160GB01D |
|                   | ±5%(J)     | GQM1875C2E160JB12D |                    | GQM1885C1H160JB01D |
| 18pF(180)         | ±2%(G)     | GQM1875C2E180GB12D |                    | GQM1885C1H180GB01D |
|                   | ±5%(J)     | GQM1875C2E180JB12D |                    | GQM1885C1H180JB01D |
| 20pF(200)         | ±2%(G)     | GQM1875C2E200GB12D |                    | GQM1885C1H200GB01D |
|                   | ±5%(J)     | GQM1875C2E200JB12D |                    | GQM1885C1H200JB01D |
| 22pF(220)         | ±2%(G)     | GQM1875C2E220GB12D |                    | GQM1885C1H220GB01D |
|                   | ±5%(J)     | GQM1875C2E220JB12D |                    | GQM1885C1H220JB01D |
| 24pF(240)         | ±2%(G)     | GQM1875C2E240GB12D |                    | GQM1885C1H240GB01D |
|                   | ±5%(J)     | GQM1875C2E240JB12D |                    | GQM1885C1H240JB01D |
| 27pF(270)         | ±2%(G)     | GQM1875C2E270GB12D |                    | GQM1885C1H270GB01D |
|                   | ±5%(J)     | GQM1875C2E270JB12D |                    | GQM1885C1H270JB01D |
| 30pF(300)         | ±2%(G)     | GQM1875C2E300GB12D |                    | GQM1885C1H300GB01D |
|                   | ±5%(J)     | GQM1875C2E300JB12D |                    | GQM1885C1H300JB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number)

GQ

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18

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B12

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①Product ID

②Series

③Dimension (LxW)

④Dimension (T)

⑤Temperature Characteristics

⑥Rated Voltage

⑦Capacitance

⑧Capacitance Tolerance

⑨Individual Specification Code

⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603>  |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 250(2E)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |
| 33pF(330)         | ±2%(G)    | GQM1875C2E330GB12D | GQM1885C1H330GB01D |
|                   | ±5%(J)    | GQM1875C2E330JB12D | GQM1885C1H330JB01D |
| 36pF(360)         | ±2%(G)    | GQM1875C2E360GB12D | GQM1885C1H360GB01D |
|                   | ±5%(J)    | GQM1875C2E360JB12D | GQM1885C1H360JB01D |
| 39pF(390)         | ±2%(G)    | GQM1875C2E390GB12D | GQM1885C1H390GB01D |
|                   | ±5%(J)    | GQM1875C2E390JB12D | GQM1885C1H390JB01D |
| 43pF(430)         | ±2%(G)    | GQM1875C2E430GB12D | GQM1885C1H430GB01D |
|                   | ±5%(J)    | GQM1875C2E430JB12D | GQM1885C1H430JB01D |
| 47pF(470)         | ±2%(G)    | GQM1875C2E470GB12D | GQM1885C1H470GB01D |
|                   | ±5%(J)    | GQM1875C2E470JB12D | GQM1885C1H470JB01D |
| 51pF(510)         | ±2%(G)    |                    | GQM1885C1H510GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H510JB01D |
| 56pF(560)         | ±2%(G)    |                    | GQM1885C1H560GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H560JB01D |
| 62pF(620)         | ±2%(G)    |                    | GQM1885C1H620GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H620JB01D |
| 68pF(680)         | ±2%(G)    |                    | GQM1885C1H680GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H680JB01D |
| 75pF(750)         | ±2%(G)    |                    | GQM1885C1H750GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H750JB01D |
| 82pF(820)         | ±2%(G)    |                    | GQM1885C1H820GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H820JB01D |
| 91pF(910)         | ±2%(G)    |                    | GQM1885C1H910GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H910JB01D |
| 100pF(101)        | ±2%(G)    |                    | GQM1885C1H101GB01D |
|                   | ±5%(J)    |                    | GQM1885C1H101JB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]             |                     | 2.0x1.25(21)<0805> |                    |
|----------------------|---------------------|--------------------|--------------------|
| Rated Volt. [Vdc]    |                     | 250(2E)            | 100(2A)            |
| Capacitance          | Tolerance           | Part Number        |                    |
| 0.50pF( <b>R50</b> ) | ±0.1pF( <b>B</b> )  | GQM2195C2ER50BB12D | GQM2195C2AR50BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2ER50CB12D | GQM2195C2AR50CB01D |
| 0.75pF( <b>R75</b> ) | ±0.1pF( <b>B</b> )  | GQM2195C2ER75BB12D | GQM2195C2AR75BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2ER75CB12D | GQM2195C2AR75CB01D |
| 1.0pF( <b>1R0</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R0BB12D | GQM2195C2A1R0BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R0CB12D | GQM2195C2A1R0CB01D |
| 1.1pF( <b>1R1</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R1BB12D | GQM2195C2A1R1BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R1CB12D | GQM2195C2A1R1CB01D |
| 1.2pF( <b>1R2</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R2BB12D | GQM2195C2A1R2BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R2CB12D | GQM2195C2A1R2CB01D |
| 1.3pF( <b>1R3</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R3BB12D | GQM2195C2A1R3BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R3CB12D | GQM2195C2A1R3CB01D |
| 1.5pF( <b>1R5</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R5BB12D | GQM2195C2A1R5BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R5CB12D | GQM2195C2A1R5CB01D |
| 1.6pF( <b>1R6</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R6BB12D | GQM2195C2A1R6BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R6CB12D | GQM2195C2A1R6CB01D |
| 1.8pF( <b>1R8</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E1R8BB12D | GQM2195C2A1R8BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E1R8CB12D | GQM2195C2A1R8CB01D |
| 2.0pF( <b>2R0</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E2R0BB12D | GQM2195C2A2R0BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E2R0CB12D | GQM2195C2A2R0CB01D |
| 2.2pF( <b>2R2</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E2R2BB12D | GQM2195C2A2R2BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E2R2CB12D | GQM2195C2A2R2CB01D |
| 2.4pF( <b>2R4</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E2R4BB12D | GQM2195C2A2R4BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E2R4CB12D | GQM2195C2A2R4CB01D |
| 2.7pF( <b>2R7</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E2R7BB12D | GQM2195C2A2R7BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E2R7CB12D | GQM2195C2A2R7CB01D |
| 3.0pF( <b>3R0</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E3R0BB12D | GQM2195C2A3R0BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E3R0CB12D | GQM2195C2A3R0CB01D |
| 3.3pF( <b>3R3</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E3R3BB12D | GQM2195C2A3R3BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E3R3CB12D | GQM2195C2A3R3CB01D |
| 3.6pF( <b>3R6</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E3R6BB12D | GQM2195C2A3R6BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E3R6CB12D | GQM2195C2A3R6CB01D |
| 3.9pF( <b>3R9</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E3R9BB12D | GQM2195C2A3R9BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E3R9CB12D | GQM2195C2A3R9CB01D |
| 4.0pF( <b>4R0</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E4R0BB12D | GQM2195C2A4R0BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E4R0CB12D | GQM2195C2A4R0CB01D |
| 4.3pF( <b>4R3</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E4R3BB12D | GQM2195C2A4R3BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E4R3CB12D | GQM2195C2A4R3CB01D |
| 4.7pF( <b>4R7</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E4R7BB12D | GQM2195C2A4R7BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E4R7CB12D | GQM2195C2A4R7CB01D |
| 5.0pF( <b>5R0</b> )  | ±0.1pF( <b>B</b> )  | GQM2195C2E5R0BB12D | GQM2195C2A5R0BB01D |
|                      | ±0.25pF( <b>C</b> ) | GQM2195C2E5R0CB12D | GQM2195C2A5R0CB01D |
| 5.1pF( <b>5R1</b> )  | ±0.25pF( <b>C</b> ) | GQM2195C2E5R1CB12D | GQM2195C2A5R1CB01D |
|                      | ±0.5pF( <b>D</b> )  | GQM2195C2E5R1DB12D | GQM2195C2A5R1DB01D |
| 5.6pF( <b>5R6</b> )  | ±0.25pF( <b>C</b> ) | GQM2195C2E5R6CB12D | GQM2195C2A5R6CB01D |
|                      | ±0.5pF( <b>D</b> )  | GQM2195C2E5R6DB12D | GQM2195C2A5R6DB01D |
| 6.0pF( <b>6R0</b> )  | ±0.25pF( <b>C</b> ) | GQM2195C2E6R0CB12D | GQM2195C2A6R0CB01D |
|                      | ±0.5pF( <b>D</b> )  | GQM2195C2E6R0DB12D | GQM2195C2A6R0DB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GQ** **M** **21** **9** **5C** **2E** **R50** **B** **B12** **D** ①Product ID ②Series ③Dimension (LxW) ④Dimension (T)  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑤Temperature Characteristics ⑥Rated Voltage ⑦Capacitance  
 ⑧Capacitance Tolerance ⑨Individual Specification Code ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 2.0x1.25(21)<0805> |                    |                    |
|-------------------|------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 250(2E)            | 100(2A)            | 50(1H)             |
| Capacitance       | Tolerance  | Part Number        |                    |                    |
| 6.2pF(6R2)        | ±0.25pF(C) | GQM2195C2E6R2CB12D | GQM2195C2A6R2CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E6R2DB12D | GQM2195C2A6R2DB01D |                    |
| 6.8pF(6R8)        | ±0.25pF(C) | GQM2195C2E6R8CB12D | GQM2195C2A6R8CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E6R8DB12D | GQM2195C2A6R8DB01D |                    |
| 7.0pF(7R0)        | ±0.25pF(C) | GQM2195C2E7R0CB12D | GQM2195C2A7R0CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E7R0DB12D | GQM2195C2A7R0DB01D |                    |
| 7.5pF(7R5)        | ±0.25pF(C) | GQM2195C2E7R5CB12D | GQM2195C2A7R5CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E7R5DB12D | GQM2195C2A7R5DB01D |                    |
| 8.0pF(8R0)        | ±0.25pF(C) | GQM2195C2E8R0CB12D | GQM2195C2A8R0CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E8R0DB12D | GQM2195C2A8R0DB01D |                    |
| 8.2pF(8R2)        | ±0.25pF(C) | GQM2195C2E8R2CB12D | GQM2195C2A8R2CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E8R2DB12D | GQM2195C2A8R2DB01D |                    |
| 9.0pF(9R0)        | ±0.25pF(C) | GQM2195C2E9R0CB12D | GQM2195C2A9R0CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E9R0DB12D | GQM2195C2A9R0DB01D |                    |
| 9.1pF(9R1)        | ±0.25pF(C) | GQM2195C2E9R1CB12D | GQM2195C2A9R1CB01D |                    |
|                   | ±0.5pF(D)  | GQM2195C2E9R1DB12D | GQM2195C2A9R1DB01D |                    |
| 10pF(100)         | ±2%(G)     | GQM2195C2E100GB12D | GQM2195C2A100GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E100JB12D | GQM2195C2A100JB01D |                    |
| 11pF(110)         | ±2%(G)     | GQM2195C2E110GB12D | GQM2195C2A110GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E110JB12D | GQM2195C2A110JB01D |                    |
| 12pF(120)         | ±2%(G)     | GQM2195C2E120GB12D | GQM2195C2A120GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E120JB12D | GQM2195C2A120JB01D |                    |
| 13pF(130)         | ±2%(G)     | GQM2195C2E130GB12D | GQM2195C2A130GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E130JB12D | GQM2195C2A130JB01D |                    |
| 15pF(150)         | ±2%(G)     | GQM2195C2E150GB12D | GQM2195C2A150GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E150JB12D | GQM2195C2A150JB01D |                    |
| 16pF(160)         | ±2%(G)     | GQM2195C2E160GB12D | GQM2195C2A160GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E160JB12D | GQM2195C2A160JB01D |                    |
| 18pF(180)         | ±2%(G)     | GQM2195C2E180GB12D | GQM2195C2A180GB01D |                    |
|                   | ±5%(J)     | GQM2195C2E180JB12D | GQM2195C2A180JB01D |                    |
| 20pF(200)         | ±2%(G)     | GQM2195C2E200GB12D |                    | GQM2195C1H200GB01D |
|                   | ±5%(J)     | GQM2195C2E200JB12D |                    | GQM2195C1H200JB01D |
| 22pF(220)         | ±2%(G)     | GQM2195C2E220GB12D |                    | GQM2195C1H220GB01D |
|                   | ±5%(J)     | GQM2195C2E220JB12D |                    | GQM2195C1H220JB01D |
| 24pF(240)         | ±2%(G)     | GQM2195C2E240GB12D |                    | GQM2195C1H240GB01D |
|                   | ±5%(J)     | GQM2195C2E240JB12D |                    | GQM2195C1H240JB01D |
| 27pF(270)         | ±2%(G)     | GQM2195C2E270GB12D |                    | GQM2195C1H270GB01D |
|                   | ±5%(J)     | GQM2195C2E270JB12D |                    | GQM2195C1H270JB01D |
| 30pF(300)         | ±2%(G)     | GQM2195C2E300GB12D |                    | GQM2195C1H300GB01D |
|                   | ±5%(J)     | GQM2195C2E300JB12D |                    | GQM2195C1H300JB01D |
| 33pF(330)         | ±2%(G)     | GQM2195C2E330GB12D |                    | GQM2195C1H330GB01D |
|                   | ±5%(J)     | GQM2195C2E330JB12D |                    | GQM2195C1H330JB01D |
| 36pF(360)         | ±2%(G)     | GQM2195C2E360GB12D |                    | GQM2195C1H360GB01D |
|                   | ±5%(J)     | GQM2195C2E360JB12D |                    | GQM2195C1H360JB01D |
| 39pF(390)         | ±2%(G)     | GQM2195C2E390GB12D |                    | GQM2195C1H390GB01D |
|                   | ±5%(J)     | GQM2195C2E390JB12D |                    | GQM2195C1H390JB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 2.0x1.25(21)<0805> |                    |
|-------------------|-----------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 250(2E)            | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |                    |
| 43pF(430)         | ±2%(G)    | GQM2195C2E430GB12D | GQM2195C1H430GB01D |
|                   | ±5%(J)    | GQM2195C2E430JB12D | GQM2195C1H430JB01D |
| 47pF(470)         | ±2%(G)    | GQM2195C2E470GB12D | GQM2195C1H470GB01D |
|                   | ±5%(J)    | GQM2195C2E470JB12D | GQM2195C1H470JB01D |
| 51pF(510)         | ±2%(G)    | GQM2195C2E510GB12D | GQM2195C1H510GB01D |
|                   | ±5%(J)    | GQM2195C2E510JB12D | GQM2195C1H510JB01D |
| 56pF(560)         | ±2%(G)    | GQM2195C2E560GB12D | GQM2195C1H560GB01D |
|                   | ±5%(J)    | GQM2195C2E560JB12D | GQM2195C1H560JB01D |
| 62pF(620)         | ±2%(G)    | GQM2195C2E620GB12D | GQM2195C1H620GB01D |
|                   | ±5%(J)    | GQM2195C2E620JB12D | GQM2195C1H620JB01D |
| 68pF(680)         | ±2%(G)    | GQM2195C2E680GB12D | GQM2195C1H680GB01D |
|                   | ±5%(J)    | GQM2195C2E680JB12D | GQM2195C1H680JB01D |
| 75pF(750)         | ±2%(G)    | GQM2195C2E750GB12D | GQM2195C1H750GB01D |
|                   | ±5%(J)    | GQM2195C2E750JB12D | GQM2195C1H750JB01D |
| 82pF(820)         | ±2%(G)    | GQM2195C2E820GB12D | GQM2195C1H820GB01D |
|                   | ±5%(J)    | GQM2195C2E820JB12D | GQM2195C1H820JB01D |
| 91pF(910)         | ±2%(G)    | GQM2195C2E910GB12D | GQM2195C1H910GB01D |
|                   | ±5%(J)    | GQM2195C2E910JB12D | GQM2195C1H910JB01D |
| 100pF(101)        | ±2%(G)    | GQM2195C2E101GB12D | GQM2195C1H101GB01D |
|                   | ±5%(J)    | GQM2195C2E101JB12D | GQM2195C1H101JB01D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **GQ** **M** **21** **9** **5C** **2E** **430** **G** **B12** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

①Product ID      ②Series  
 ⑤Temperature Characteristics  
 ⑧Capacitance Tolerance

③Dimension (LxW)  
 ⑥Rated Voltage  
 ⑨Individual Specification Code

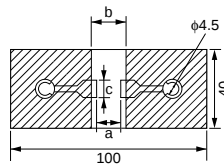
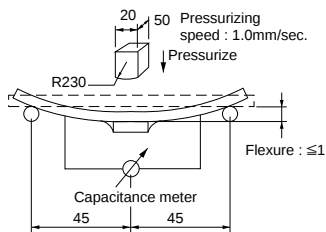
④Dimension (T)  
 ⑦Capacitance  
 ⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.



## GQM Series Specifications and Test Methods

Continued from the preceding page.

| No.                                                                                               | Item                                                                                 |                                                                                                                                                                                                                                                                                                                                         | Specifications                                                                                                                         | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------|------------|---|-------|------------|------------------------------|------------|------------------------------|------------|-------------|-----------|--------|-----------|--------|
| 12                                                                                                | Deflection                                                                           | Appearance                                                                                                                                                                                                                                                                                                                              | No marking defects                                                                                                                     | <p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder.</p> <p>Then apply a force in the direction shown in Fig. 3.</p> <p>The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>                                                                                                                                                                                                                                                                                                                                                         |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Capacitance Change                                                                                                                                                                                                                                                                                                                      | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      |  <table><thead><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr></thead><tbody><tr><td>GQM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GQM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr></tbody></table> <p>(in mm)</p> <p>Fig. 2</p> |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Type       | a                            | b          | c | GQM18 | 1.0        | 3.0                          | 1.2        | GQM21                        | 1.2        | 4.0         | 1.65      |        |           |        |
|                                                                                                   |                                                                                      | Type                                                                                                                                                                                                                                                                                                                                    | a                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | b          | c                            |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| GQM18                                                                                             | 1.0                                                                                  | 3.0                                                                                                                                                                                                                                                                                                                                     | 1.2                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| GQM21                                                                                             | 1.2                                                                                  | 4.0                                                                                                                                                                                                                                                                                                                                     | 1.65                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|  <p>Fig. 3</p> |                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| 13                                                                                                | Solderability of Termination                                                         |                                                                                                                                                                                                                                                                                                                                         | 75% of the terminations are to be soldered evenly and continuously.                                                                    | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for <math>2\pm 0.5</math> seconds at <math>230\pm 5^\circ\text{C}</math> or Sn-3.0Ag-0.5Cu solder solution for <math>2\pm 0.5</math> seconds at <math>245\pm 5^\circ\text{C}</math>.</p>                                                                                                                                                                                                                                                                              |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| 14                                                                                                | Resistance to Soldering Heat                                                         | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                                     |                                                                                                                                        | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at <math>270\pm 5^\circ\text{C}</math> for <math>10\pm 0.5</math> seconds. Let sit at room temperature for <math>24\pm 2</math> hours.</p>                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Appearance                                                                                                                                                                                                                                                                                                                              | No marking defects                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Capacitance Change                                                                                                                                                                                                                                                                                                                      | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Q                                                                                                                                                                                                                                                                                                                                       | 30pF min.: $Q\geq 1400$<br>30pF max.: $Q\geq 800+20C$<br>C: Nominal Capacitance (pF)                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | I.R.                                                                                                                                                                                                                                                                                                                                    | More than 10,000MΩ                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| Dielectric Strength                                                                               |                                                                                      | No failure                                                                                                                                                                                                                                                                                                                              |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| 15                                                                                                | Temperature Cycle                                                                    | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                                     |                                                                                                                                        | <p>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).</p> <p>Perform the five cycles according to the four heat treatments listed in the following table.</p> <p>Let sit for <math>24\pm 2</math> hours at room temperature, then measure.</p> <table><thead><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr></thead><tbody><tr><td>Temp. (°C)</td><td>Min. Operating Temp. <math>+0/-3</math></td><td>Room Temp.</td><td>Max. Operating Temp. <math>+3/-0</math></td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td><math>30\pm 3</math></td><td>2 to 3</td><td><math>30\pm 3</math></td><td>2 to 3</td></tr></tbody></table> | Step       | 1                            | 2          | 3 | 4     | Temp. (°C) | Min. Operating Temp. $+0/-3$ | Room Temp. | Max. Operating Temp. $+3/-0$ | Room Temp. | Time (min.) | $30\pm 3$ | 2 to 3 | $30\pm 3$ | 2 to 3 |
|                                                                                                   |                                                                                      | Step                                                                                                                                                                                                                                                                                                                                    | 1                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2          | 3                            | 4          |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Temp. (°C)                                                                                                                                                                                                                                                                                                                              | Min. Operating Temp. $+0/-3$                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Room Temp. | Max. Operating Temp. $+3/-0$ | Room Temp. |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Time (min.)                                                                                                                                                                                                                                                                                                                             | $30\pm 3$                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 to 3     | $30\pm 3$                    | 2 to 3     |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Appearance                                                                                                                                                                                                                                                                                                                              | No marking defects                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Capacitance Change                                                                                                                                                                                                                                                                                                                      | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| Q                                                                                                 | 30pF min.: $Q\geq 1400$<br>30pF max.: $Q\geq 800+20C$<br>C: Nominal Capacitance (pF) |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| I.R.                                                                                              | More than 10,000MΩ                                                                   |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| Dielectric Strength                                                                               |                                                                                      | No failure                                                                                                                                                                                                                                                                                                                              |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
| 16                                                                                                | Humidity Steady State                                                                | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                                     |                                                                                                                                        | <p>Let the capacitor sit at <math>40\pm 2^\circ\text{C}</math> and 90 to 95% humidity for <math>500\pm 12</math> hours.</p> <p>Remove and let sit for <math>24\pm 2</math> hours (temperature compensating type) at room temperature, then measure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Appearance                                                                                                                                                                                                                                                                                                                              | No marking defects                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Capacitance Change                                                                                                                                                                                                                                                                                                                      | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | Q                                                                                                                                                                                                                                                                                                                                       | 30pF min.: $Q\geq 350$<br>10pF and over, 30pF and below: $Q\geq 275+5C/2$<br>10pF max.: $Q\geq 200+10C$<br>C: Nominal Capacitance (pF) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |
|                                                                                                   |                                                                                      | I.R.                                                                                                                                                                                                                                                                                                                                    | More than 1,000MΩ                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                              |            |   |       |            |                              |            |                              |            |             |           |        |           |        |

Continued on the following page. 

## 5



| No. | Item                  | Specifications     | Test Method                                                                                         |                                                                                                                                               |
|-----|-----------------------|--------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 17  | Humidity Load         |                    | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                               |
|     |                       | Appearance         |                                                                                                     | No marking defects                                                                                                                            |
|     |                       | Capacitance Change |                                                                                                     | Within $\pm 7.5\%$ or $\pm 0.75\text{pF}$ (Whichever is larger)                                                                               |
|     |                       | Q                  |                                                                                                     | 30pF min.: $Q \geq 200$<br>30pF max.: $Q \geq 100+10C/3$<br><br>C: Nominal Capacitance (pF)                                                   |
|     |                       | I.R.               |                                                                                                     | More than 500M $\Omega$                                                                                                                       |
| 18  | High Temperature Load |                    | The measured and observed characteristics should satisfy the specifications in the following table. |                                                                                                                                               |
|     |                       | Appearance         |                                                                                                     | No marking defects                                                                                                                            |
|     |                       | Capacitance Change |                                                                                                     | Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)                                                                                  |
|     |                       | Q                  |                                                                                                     | 30pF min.: $Q \geq 350$<br>10pF and over, 30pF and below: $Q \geq 275+5C/2$<br>10pF max.: $Q \geq 200+10C$<br><br>C: Nominal Capacitance (pF) |
|     |                       | I.R.               |                                                                                                     | More than 1,000M $\Omega$                                                                                                                     |

|    |               |                    |                                                                                                                                                                                               |                                                                               |
|----|---------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 17 | Humidity Load |                    | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature then measure. The charge/discharge current is less than 50mA. |                                                                               |
|    |               | Appearance         |                                                                                                                                                                                               | No marking defects                                                            |
|    |               | Capacitance Change |                                                                                                                                                                                               | Within ±7.5% or ±0.75pF (Whichever is larger)                                 |
|    |               | Q                  |                                                                                                                                                                                               | 30pF min.: Q≥200<br>30pF max.: Q≥100+10C/3<br><br>C: Nominal Capacitance (pF) |
|    |               | I.R.               |                                                                                                                                                                                               | More than 500MΩ                                                               |

|    |                       |                    |                                                                                                                                                                                                                                       |                                                                                                                          |
|----|-----------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 18 | High Temperature Load |                    | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. The charge/discharge current is less than 50mA. |                                                                                                                          |
|    |                       | Appearance         |                                                                                                                                                                                                                                       | No marking defects                                                                                                       |
|    |                       | Capacitance Change |                                                                                                                                                                                                                                       | Within ±3% or ±0.3pF (Whichever is larger)                                                                               |
|    |                       | Q                  |                                                                                                                                                                                                                                       | 30pF min.: Q≥350<br>10pF and over, 30pF and below: Q≥275+5C/2<br>10pF max.: Q≥200+10C<br><br>C: Nominal Capacitance (pF) |
|    |                       | I.R.               |                                                                                                                                                                                                                                       | More than 1,000MΩ                                                                                                        |

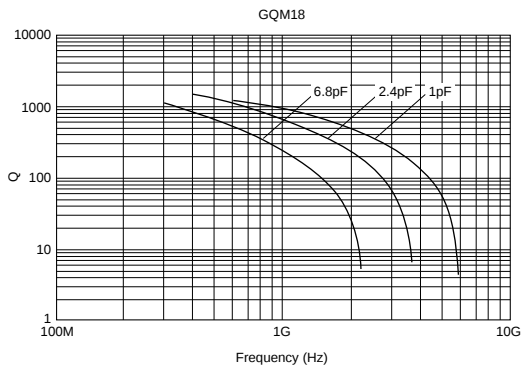
Table A

| Char.     | Nominal Values<br>(ppm/°C) *1 | Capacitance Change from 25°C (%) |       |       |       |       |       |
|-----------|-------------------------------|----------------------------------|-------|-------|-------|-------|-------|
|           |                               | -55°C                            |       | -30°C |       | -10°C |       |
|           |                               | Max.                             | Min.  | Max.  | Min.  | Max.  | Min.  |
| <b>5C</b> | 0±30                          | 0.58                             | -0.24 | 0.40  | -0.17 | 0.25  | -0.11 |

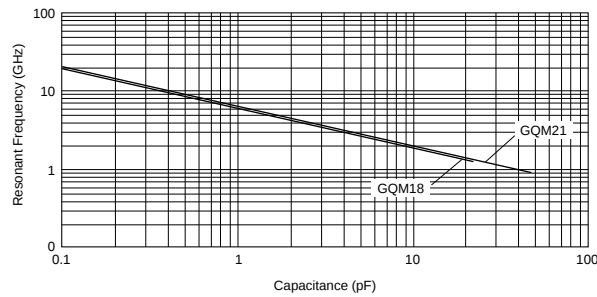
\*1: Nominal values denote the temperature coefficient within a range of 25 to 125°C.

# GQM Series Data

## ■ Q - Frequency Characteristics



## ■ Resonant Frequency - Capacitance



# Chip Monolithic Ceramic Capacitors



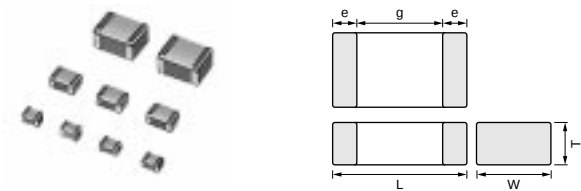
## High Frequency Type ERB Series

### ■ Features (ERB Series)

- 1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
- 2. Nickel barriered terminations of ERB series improve solderability and decrease solder leaching.
- 3. ERB18/21 series are designed for both flow and reflow soldering and ERB32 series are designed for reflow soldering.

### ■ Applications

High frequency and high-power circuits



| Part Number | Dimensions (mm) |          |        |        |        |
|-------------|-----------------|----------|--------|--------|--------|
|             | L               | W        | T max. | e min. | g min. |
| ERB188      | 1.6±0.1         | 0.8±0.1  | 0.9    | 0.2    | 0.5    |
| ERB21B      | 2.0±0.3         | 1.25±0.3 | 1.35   | 0.25   | 0.7    |
| ERB32Q      | 3.2±0.3         | 2.5±0.3  | 1.7    | 0.3    | 1.0    |

Capacitance Table

Temperature Compensating Type C0G(5C) Characteristics

| Capacitance | 8                   |   | ex.8: T Dimension [mm] |                      |                     |         |          |          |          |          |         |  |
|-------------|---------------------|---|------------------------|----------------------|---------------------|---------|----------|----------|----------|----------|---------|--|
|             | TC                  |   | C0G(5C)                |                      |                     |         |          |          |          |          |         |  |
|             | LxW [mm]            |   | 1.6x0.8 (18) <0603>    | 2.0x1.25 (21) <0805> | 3.2x2.5 (32) <1210> |         |          |          |          |          |         |  |
|             | Rated Voltage [Vdc] |   | 250 (2E)               | 250 (2E)             | 100 (2A)            | 50 (1H) | 500 (2H) | 300 (YD) | 250 (2E) | 100 (2A) | 50 (1H) |  |
| 0.50pF(R50) | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 0.75pF(R75) | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.0pF(1R0)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.1pF(1R1)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.2pF(1R2)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.3pF(1R3)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.5pF(1R5)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.6pF(1R6)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 1.8pF(1R8)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 2.0pF(2R0)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 2.2pF(2R2)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 2.4pF(2R4)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 2.7pF(2R7)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 3.0pF(3R0)  | 8                   | B |                        |                      |                     |         |          |          |          |          |         |  |
| 3.3pF(3R3)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 3.6pF(3R6)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 3.9pF(3R9)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 4.0pF(4R0)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 4.3pF(4R3)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 4.7pF(4R7)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 5.0pF(5R0)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 5.1pF(5R1)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 5.6pF(5R6)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 6.0pF(6R0)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 6.2pF(6R2)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 6.8pF(6R8)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 7.0pF(7R0)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 7.5pF(7R5)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 8.0pF(8R0)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 8.2pF(8R2)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 9.0pF(9R0)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 9.1pF(9R1)  | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 10pF(100)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 11pF(110)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 12pF(120)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 13pF(130)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 15pF(150)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 16pF(160)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 18pF(180)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 20pF(200)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 22pF(220)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 24pF(240)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 27pF(270)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 30pF(300)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 33pF(330)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 36pF(360)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 39pF(390)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |
| 43pF(430)   | 8                   | B |                        |                      |                     |         | Q        |          |          |          |         |  |

| Capacitance | TC                  |   | C0G(5C)             |                      |                     |         |          |          |          |          |         |  |
|-------------|---------------------|---|---------------------|----------------------|---------------------|---------|----------|----------|----------|----------|---------|--|
|             | LxW [mm]            |   | 1.6x0.8 (18) <0603> | 2.0x1.25 (21) <0805> | 3.2x2.5 (32) <1210> |         |          |          |          |          |         |  |
|             | Rated Voltage [Vdc] |   | 250 (2E)            | 250 (2E)             | 100 (2A)            | 50 (1H) | 500 (2H) | 300 (YD) | 250 (2E) | 100 (2A) | 50 (1H) |  |
|             |                     |   |                     |                      |                     |         |          |          |          |          |         |  |
| 47pF(470)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 51pF(510)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 56pF(560)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 62pF(620)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 68pF(680)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 75pF(750)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 82pF(820)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 91pF(910)   | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 100pF(101)  | 8                   | B |                     |                      |                     |         | Q        |          |          |          |         |  |
| 110pF(111)  |                     |   |                     | B                    |                     |         | Q        |          |          |          |         |  |
| 120pF(121)  |                     |   |                     | B                    |                     |         | Q        |          |          |          |         |  |
| 130pF(131)  |                     |   |                     | B                    |                     |         |          | Q        |          |          |         |  |
| 150pF(151)  |                     |   |                     |                      | B                   |         |          | Q        |          |          |         |  |
| 160pF(161)  |                     |   |                     |                      | B                   |         |          |          | Q        |          |         |  |
| 180pF(181)  |                     |   |                     |                      |                     |         |          |          | Q        |          |         |  |
| 200pF(201)  |                     |   |                     |                      |                     |         |          |          | Q        |          |         |  |
| 220pF(221)  |                     |   |                     |                      |                     |         |          |          | Q        |          |         |  |
| 240pF(241)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 270pF(271)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 300pF(301)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 330pF(331)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 360pF(361)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 390pF(391)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 430pF(431)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 470pF(471)  |                     |   |                     |                      |                     |         |          |          |          | Q        |         |  |
| 510pF(511)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 560pF(561)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 620pF(621)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 680pF(681)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 750pF(751)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 820pF(821)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 910pF(911)  |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |
| 1000pF(102) |                     |   |                     |                      |                     |         |          |          |          |          | Q       |  |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 1.6x0.8(18)<0603>  | 2.0x1.25(21)<0805> |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 250(2E)            | 250(2E)            |
| Capacitance       | Tolerance  | Part Number        |                    |
| 0.50pF(R50)       | ±0.1pF(B)  | ERB1885C2ER50BDX1D | ERB21B5C2ER50BDX1L |
|                   | ±0.25pF(C) | ERB1885C2ER50CDX1D | ERB21B5C2ER50CDX1L |
| 0.75pF(R75)       | ±0.1pF(B)  | ERB1885C2ER75BDX1D | ERB21B5C2ER75BDX1L |
|                   | ±0.25pF(C) | ERB1885C2ER75CDX1D | ERB21B5C2ER75CDX1L |
| 1.0pF(1R0)        | ±0.1pF(B)  | ERB1885C2E1R0BDX1D | ERB21B5C2E1R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R0CDX1D | ERB21B5C2E1R0CDX1L |
| 1.1pF(1R1)        | ±0.1pF(B)  | ERB1885C2E1R1BDX1D | ERB21B5C2E1R1BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R1CDX1D | ERB21B5C2E1R1CDX1L |
| 1.2pF(1R2)        | ±0.1pF(B)  | ERB1885C2E1R2BDX1D | ERB21B5C2E1R2BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R2CDX1D | ERB21B5C2E1R2CDX1L |
| 1.3pF(1R3)        | ±0.1pF(B)  | ERB1885C2E1R3BDX1D | ERB21B5C2E1R3BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R3CDX1D | ERB21B5C2E1R3CDX1L |
| 1.5pF(1R5)        | ±0.1pF(B)  | ERB1885C2E1R5BDX1D | ERB21B5C2E1R5BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R5CDX1D | ERB21B5C2E1R5CDX1L |
| 1.6pF(1R6)        | ±0.1pF(B)  | ERB1885C2E1R6BDX1D | ERB21B5C2E1R6BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R6CDX1D | ERB21B5C2E1R6CDX1L |
| 1.8pF(1R8)        | ±0.1pF(B)  | ERB1885C2E1R8BDX1D | ERB21B5C2E1R8BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E1R8CDX1D | ERB21B5C2E1R8CDX1L |
| 2.0pF(2R0)        | ±0.1pF(B)  | ERB1885C2E2R0BDX1D | ERB21B5C2E2R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E2R0CDX1D | ERB21B5C2E2R0CDX1L |
| 2.2pF(2R2)        | ±0.1pF(B)  | ERB1885C2E2R2BDX1D | ERB21B5C2E2R2BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E2R2CDX1D | ERB21B5C2E2R2CDX1L |
| 2.4pF(2R4)        | ±0.1pF(B)  | ERB1885C2E2R4BDX1D | ERB21B5C2E2R4BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E2R4CDX1D | ERB21B5C2E2R4CDX1L |
| 2.7pF(2R7)        | ±0.1pF(B)  | ERB1885C2E2R7BDX1D | ERB21B5C2E2R7BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E2R7CDX1D | ERB21B5C2E2R7CDX1L |
| 3.0pF(3R0)        | ±0.1pF(B)  | ERB1885C2E3R0BDX1D | ERB21B5C2E3R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E3R0CDX1D | ERB21B5C2E3R0CDX1L |
| 3.3pF(3R3)        | ±0.1pF(B)  | ERB1885C2E3R3BDX1D | ERB21B5C2E3R3BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E3R3CDX1D | ERB21B5C2E3R3CDX1L |
| 3.6pF(3R6)        | ±0.1pF(B)  | ERB1885C2E3R6BDX1D | ERB21B5C2E3R6BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E3R6CDX1D | ERB21B5C2E3R6CDX1L |
| 3.9pF(3R9)        | ±0.1pF(B)  | ERB1885C2E3R9BDX1D | ERB21B5C2E3R9BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E3R9CDX1D | ERB21B5C2E3R9CDX1L |
| 4.0pF(4R0)        | ±0.1pF(B)  | ERB1885C2E4R0BDX1D | ERB21B5C2E4R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E4R0CDX1D | ERB21B5C2E4R0CDX1L |
| 4.3pF(4R3)        | ±0.1pF(B)  | ERB1885C2E4R3BDX1D | ERB21B5C2E4R3BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E4R3CDX1D | ERB21B5C2E4R3CDX1L |
| 4.7pF(4R7)        | ±0.1pF(B)  | ERB1885C2E4R7BDX1D | ERB21B5C2E4R7BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E4R7CDX1D | ERB21B5C2E4R7CDX1L |
| 5.0pF(5R0)        | ±0.1pF(B)  | ERB1885C2E5R0BDX1D | ERB21B5C2E5R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E5R0CDX1D | ERB21B5C2E5R0CDX1L |
| 5.1pF(5R1)        | ±0.1pF(B)  | ERB1885C2E5R1BDX1D | ERB21B5C2E5R1BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E5R1CDX1D | ERB21B5C2E5R1CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E5R1DDX1D | ERB21B5C2E5R1DDX1L |
| 5.6pF(5R6)        | ±0.1pF(B)  | ERB1885C2E5R6BDX1D | ERB21B5C2E5R6BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E5R6CDX1D | ERB21B5C2E5R6CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E5R6DDX1D | ERB21B5C2E5R6DDX1L |
| 6.0pF(6R0)        | ±0.1pF(B)  | ERB1885C2E6R0BDX1D | ERB21B5C2E6R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E6R0CDX1D | ERB21B5C2E6R0CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E6R0DDX1D | ERB21B5C2E6R0DDX1L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **ER** **B** **18** **8** **5C** **2E** **R50** **B** **DX1** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 1.6x0.8(18)<0603>  | 2.0x1.25(21)<0805> |
|-------------------|------------|--------------------|--------------------|
| Rated Volt. [Vdc] |            | 250(2E)            | 250(2E)            |
| Capacitance       | Tolerance  | Part Number        |                    |
| 6.2pF(6R2)        | ±0.1pF(B)  | ERB1885C2E6R2BDX1D | ERB21B5C2E6R2BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E6R2CDX1D | ERB21B5C2E6R2CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E6R2DDX1D | ERB21B5C2E6R2DDX1L |
| 6.8pF(6R8)        | ±0.1pF(B)  | ERB1885C2E6R8BDX1D | ERB21B5C2E6R8BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E6R8CDX1D | ERB21B5C2E6R8CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E6R8DDX1D | ERB21B5C2E6R8DDX1L |
| 7.0pF(7R0)        | ±0.1pF(B)  | ERB1885C2E7R0BDX5D | ERB21B5C2E7R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E7R0CDX5D | ERB21B5C2E7R0CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E7R0DDX5D | ERB21B5C2E7R0DDX1L |
| 7.5pF(7R5)        | ±0.1pF(B)  | ERB1885C2E7R5BDX5D | ERB21B5C2E7R5BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E7R5CDX5D | ERB21B5C2E7R5CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E7R5DDX5D | ERB21B5C2E7R5DDX1L |
| 8.0pF(8R0)        | ±0.1pF(B)  | ERB1885C2E8R0BDX5D | ERB21B5C2E8R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E8R0CDX5D | ERB21B5C2E8R0CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E8R0DDX5D | ERB21B5C2E8R0DDX1L |
| 8.2pF(8R2)        | ±0.1pF(B)  | ERB1885C2E8R2BDX5D | ERB21B5C2E8R2BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E8R2CDX5D | ERB21B5C2E8R2CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E8R2DDX5D | ERB21B5C2E8R2DDX1L |
| 9.0pF(9R0)        | ±0.1pF(B)  | ERB1885C2E9R0BDX5D | ERB21B5C2E9R0BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E9R0CDX5D | ERB21B5C2E9R0CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E9R0DDX5D | ERB21B5C2E9R0DDX1L |
| 9.1pF(9R1)        | ±0.1pF(B)  | ERB1885C2E9R1BDX5D | ERB21B5C2E9R1BDX1L |
|                   | ±0.25pF(C) | ERB1885C2E9R1CDX5D | ERB21B5C2E9R1CDX1L |
|                   | ±0.5pF(D)  | ERB1885C2E9R1DDX5D | ERB21B5C2E9R1DDX1L |
| 10pF(100)         | ±2%(G)     | ERB1885C2E100GDX5D | ERB21B5C2E100GDX1L |
|                   | ±5%(J)     | ERB1885C2E100JDX5D | ERB21B5C2E100JDX1L |
| 11pF(110)         | ±2%(G)     | ERB1885C2E110GDX5D | ERB21B5C2E110GDX1L |
|                   | ±5%(J)     | ERB1885C2E110JDX5D | ERB21B5C2E110JDX1L |
| 12pF(120)         | ±2%(G)     | ERB1885C2E120GDX5D | ERB21B5C2E120GDX1L |
|                   | ±5%(J)     | ERB1885C2E120JDX5D | ERB21B5C2E120JDX1L |
| 13pF(130)         | ±2%(G)     | ERB1885C2E130GDX5D | ERB21B5C2E130GDX1L |
|                   | ±5%(J)     | ERB1885C2E130JDX5D | ERB21B5C2E130JDX1L |
| 15pF(150)         | ±2%(G)     | ERB1885C2E150GDX5D | ERB21B5C2E150GDX1L |
|                   | ±5%(J)     | ERB1885C2E150JDX5D | ERB21B5C2E150JDX1L |
| 16pF(160)         | ±2%(G)     | ERB1885C2E160GDX5D | ERB21B5C2E160GDX1L |
|                   | ±5%(J)     | ERB1885C2E160JDX5D | ERB21B5C2E160JDX1L |
| 18pF(180)         | ±2%(G)     | ERB1885C2E180GDX5D | ERB21B5C2E180GDX1L |
|                   | ±5%(J)     | ERB1885C2E180JDX5D | ERB21B5C2E180JDX1L |
| 20pF(200)         | ±2%(G)     | ERB1885C2E200GDX5D | ERB21B5C2E200GDX1L |
|                   | ±5%(J)     | ERB1885C2E200JDX5D | ERB21B5C2E200JDX1L |
| 22pF(220)         | ±2%(G)     | ERB1885C2E220GDX5D | ERB21B5C2E220GDX1L |
|                   | ±5%(J)     | ERB1885C2E220JDX5D | ERB21B5C2E220JDX1L |
| 24pF(240)         | ±2%(G)     | ERB1885C2E240GDX5D | ERB21B5C2E240GDX1L |
|                   | ±5%(J)     | ERB1885C2E240JDX5D | ERB21B5C2E240JDX1L |
| 27pF(270)         | ±2%(G)     | ERB1885C2E270GDX5D | ERB21B5C2E270GDX1L |
|                   | ±5%(J)     | ERB1885C2E270JDX5D | ERB21B5C2E270JDX1L |
| 30pF(300)         | ±2%(G)     | ERB1885C2E300GDX5D | ERB21B5C2E300GDX1L |
|                   | ±5%(J)     | ERB1885C2E300JDX5D | ERB21B5C2E300JDX1L |
| 33pF(330)         | ±2%(G)     | ERB1885C2E330GDX5D | ERB21B5C2E330GDX1L |
|                   | ±5%(J)     | ERB1885C2E330JDX5D | ERB21B5C2E330JDX1L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) **ER** **B** **18** **8** **5C** **2E** **6R2** **B** **DX1** **D**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID      ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 1.6x0.8(18)<0603>  |                    | 2.0x1.25(21)<0805> |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 250(2E)            |                    | 250(2E)            | 100(2A) 50(1H)     |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 36pF(360)         | ±2%(G)    | ERB1885C2E360GDX5D | ERB21B5C2E360GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E360JDX5D | ERB21B5C2E360JDX1L |                    |                    |
| 39pF(390)         | ±2%(G)    | ERB1885C2E390GDX5D | ERB21B5C2E390GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E390JDX5D | ERB21B5C2E390JDX1L |                    |                    |
| 43pF(430)         | ±2%(G)    | ERB1885C2E430GDX5D | ERB21B5C2E430GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E430JDX5D | ERB21B5C2E430JDX1L |                    |                    |
| 47pF(470)         | ±2%(G)    | ERB1885C2E470GDX5D | ERB21B5C2E470GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E470JDX5D | ERB21B5C2E470JDX1L |                    |                    |
| 51pF(510)         | ±2%(G)    | ERB1885C2E510GDX5D | ERB21B5C2E510GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E510JDX5D | ERB21B5C2E510JDX1L |                    |                    |
| 56pF(560)         | ±2%(G)    | ERB1885C2E560GDX5D | ERB21B5C2E560GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E560JDX5D | ERB21B5C2E560JDX1L |                    |                    |
| 62pF(620)         | ±2%(G)    | ERB1885C2E620GDX5D | ERB21B5C2E620GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E620JDX5D | ERB21B5C2E620JDX1L |                    |                    |
| 68pF(680)         | ±2%(G)    | ERB1885C2E680GDX5D | ERB21B5C2E680GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E680JDX5D | ERB21B5C2E680JDX1L |                    |                    |
| 75pF(750)         | ±2%(G)    | ERB1885C2E750GDX5D | ERB21B5C2E750GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E750JDX5D | ERB21B5C2E750JDX1L |                    |                    |
| 82pF(820)         | ±2%(G)    | ERB1885C2E820GDX5D | ERB21B5C2E820GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E820JDX5D | ERB21B5C2E820JDX1L |                    |                    |
| 91pF(910)         | ±2%(G)    | ERB1885C2E910GDX5D | ERB21B5C2E910GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E910JDX5D | ERB21B5C2E910JDX1L |                    |                    |
| 100pF(101)        | ±2%(G)    | ERB1885C2E101GDX5D | ERB21B5C2E101GDX1L |                    |                    |
|                   | ±5%(J)    | ERB1885C2E101JDX5D | ERB21B5C2E101JDX1L |                    |                    |
| 110pF(111)        | ±2%(G)    |                    |                    | ERB21B5C2A111GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB21B5C2A111JDX1L |                    |
| 120pF(121)        | ±2%(G)    |                    |                    | ERB21B5C2A121GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB21B5C2A121JDX1L |                    |
| 130pF(131)        | ±2%(G)    |                    |                    | ERB21B5C2A131GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB21B5C2A131JDX1L |                    |
| 150pF(151)        | ±2%(G)    |                    |                    |                    | ERB21B5C1H151GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB21B5C1H151JDX1L |
| 160pF(161)        | ±2%(G)    |                    |                    |                    | ERB21B5C1H161GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB21B5C1H161JDX1L |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |            | 3.2x2.5(32)<1210>  |
|-------------------|------------|--------------------|
| Rated Volt. [Vdc] |            | 500(2H)            |
| Capacitance       | Tolerance  | Part Number        |
| 3.3pF(3R3)        | ±0.1pF(B)  | ERB32Q5C2H3R3BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H3R3CDX1L |
| 3.6pF(3R6)        | ±0.1pF(B)  | ERB32Q5C2H3R6BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H3R6CDX1L |
| 3.9pF(3R9)        | ±0.1pF(B)  | ERB32Q5C2H3R9BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H3R9CDX1L |
| 4.0pF(4R0)        | ±0.1pF(B)  | ERB32Q5C2H4R0BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H4R0CDX1L |
| 4.3pF(4R3)        | ±0.1pF(B)  | ERB32Q5C2H4R3BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H4R3CDX1L |
| 4.7pF(4R7)        | ±0.1pF(B)  | ERB32Q5C2H4R7BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H4R7CDX1L |
| 5.0pF(5R0)        | ±0.1pF(B)  | ERB32Q5C2H5R0BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H5R0CDX1L |
| 5.1pF(5R1)        | ±0.1pF(B)  | ERB32Q5C2H5R1BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H5R1CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H5R1DDX1L |
| 5.6pF(5R6)        | ±0.1pF(B)  | ERB32Q5C2H5R6BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H5R6CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H5R6DDX1L |
| 6.0pF(6R0)        | ±0.1pF(B)  | ERB32Q5C2H6R0BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H6R0CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H6R0DDX1L |
| 6.2pF(6R2)        | ±0.1pF(B)  | ERB32Q5C2H6R2BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H6R2CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H6R2DDX1L |
| 6.8pF(6R8)        | ±0.1pF(B)  | ERB32Q5C2H6R8BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H6R8CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H6R8DDX1L |
| 7.0pF(7R0)        | ±0.1pF(B)  | ERB32Q5C2H7R0BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H7R0CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H7R0DDX1L |
| 7.5pF(7R5)        | ±0.1pF(B)  | ERB32Q5C2H7R5BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H7R5CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H7R5DDX1L |
| 8.0pF(8R0)        | ±0.1pF(B)  | ERB32Q5C2H8R0BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H8R0CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H8R0DDX1L |
| 8.2pF(8R2)        | ±0.1pF(B)  | ERB32Q5C2H8R2BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H8R2CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H8R2DDX1L |
| 9.0pF(9R0)        | ±0.1pF(B)  | ERB32Q5C2H9R0BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H9R0CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H9R0DDX1L |
| 9.1pF(9R1)        | ±0.1pF(B)  | ERB32Q5C2H9R1BDX1L |
|                   | ±0.25pF(C) | ERB32Q5C2H9R1CDX1L |
|                   | ±0.5pF(D)  | ERB32Q5C2H9R1DDX1L |
| 10pF(100)         | ±2%(G)     | ERB32Q5C2H100GDX1L |
|                   | ±5%(J)     | ERB32Q5C2H100JDX1L |

| LxW [mm]          |           | 3.2x2.5(32)<1210>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 500(2H)            |
| Capacitance       | Tolerance | Part Number        |
| 11pF(110)         | ±2%(G)    | ERB32Q5C2H110GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H110JDX1L |
| 12pF(120)         | ±2%(G)    | ERB32Q5C2H120GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H120JDX1L |
| 13pF(130)         | ±2%(G)    | ERB32Q5C2H130GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H130JDX1L |
| 15pF(150)         | ±2%(G)    | ERB32Q5C2H150GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H150JDX1L |
| 16pF(160)         | ±2%(G)    | ERB32Q5C2H160GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H160JDX1L |
| 18pF(180)         | ±2%(G)    | ERB32Q5C2H180GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H180JDX1L |
| 20pF(200)         | ±2%(G)    | ERB32Q5C2H200GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H200JDX1L |
| 22pF(220)         | ±2%(G)    | ERB32Q5C2H220GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H220JDX1L |
| 24pF(240)         | ±2%(G)    | ERB32Q5C2H240GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H240JDX1L |
| 27pF(270)         | ±2%(G)    | ERB32Q5C2H270GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H270JDX1L |
| 30pF(300)         | ±2%(G)    | ERB32Q5C2H300GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H300JDX1L |
| 33pF(330)         | ±2%(G)    | ERB32Q5C2H330GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H330JDX1L |
| 36pF(360)         | ±2%(G)    | ERB32Q5C2H360GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H360JDX1L |
| 39pF(390)         | ±2%(G)    | ERB32Q5C2H390GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H390JDX1L |
| 43pF(430)         | ±2%(G)    | ERB32Q5C2H430GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H430JDX1L |
| 47pF(470)         | ±2%(G)    | ERB32Q5C2H470GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H470JDX1L |
| 51pF(510)         | ±2%(G)    | ERB32Q5C2H510GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H510JDX1L |
| 56pF(560)         | ±2%(G)    | ERB32Q5C2H560GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H560JDX1L |
| 62pF(620)         | ±2%(G)    | ERB32Q5C2H620GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H620JDX1L |
| 68pF(680)         | ±2%(G)    | ERB32Q5C2H680GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H680JDX1L |
| 75pF(750)         | ±2%(G)    | ERB32Q5C2H750GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H750JDX1L |
| 82pF(820)         | ±2%(G)    | ERB32Q5C2H820GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H820JDX1L |
| 91pF(910)         | ±2%(G)    | ERB32Q5C2H910GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H910JDX1L |
| 100pF(101)        | ±2%(G)    | ERB32Q5C2H101GDX1L |
|                   | ±5%(J)    | ERB32Q5C2H101JDX1L |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

(Part Number) **ER** **B** **32** **Q** **5C** **2H** **3R3** **B** **DX1** **L**  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID      ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)      ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)      ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

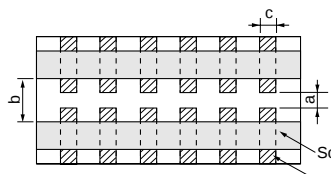
## Temperature Compensating Type C0G(5C) Characteristics

| LxW [mm]          |           | 3.2x2.5(32)<1210>  |                    |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 500(2H)            | 300(YD)            | 250(2E)            | 100(2A)            |
| Capacitance       | Tolerance | Part Number        |                    |                    |                    |
| 110pF(111)        | ±2%(G)    | ERB32Q5C2H111GDX1L |                    |                    |                    |
|                   | ±5%(J)    | ERB32Q5C2H111JDX1L |                    |                    |                    |
| 120pF(121)        | ±2%(G)    | ERB32Q5C2H121GDX1L |                    |                    |                    |
|                   | ±5%(J)    | ERB32Q5C2H121JDX1L |                    |                    |                    |
| 130pF(131)        | ±2%(G)    |                    | ERB32Q5CYD131GDX1L |                    |                    |
|                   | ±5%(J)    |                    | ERB32Q5CYD131JDX1L |                    |                    |
| 150pF(151)        | ±2%(G)    |                    | ERB32Q5CYD151GDX1L |                    |                    |
|                   | ±5%(J)    |                    | ERB32Q5CYD151JDX1L |                    |                    |
| 160pF(161)        | ±2%(G)    |                    |                    | ERB32Q5C2E161GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB32Q5C2E161JDX1L |                    |
| 180pF(181)        | ±2%(G)    |                    |                    | ERB32Q5C2E181GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB32Q5C2E181JDX1L |                    |
| 200pF(201)        | ±2%(G)    |                    |                    | ERB32Q5C2E201GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB32Q5C2E201JDX1L |                    |
| 220pF(221)        | ±2%(G)    |                    |                    | ERB32Q5C2E221GDX1L |                    |
|                   | ±5%(J)    |                    |                    | ERB32Q5C2E221JDX1L |                    |
| 240pF(241)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A241GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A241JDX1L |
| 270pF(271)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A271GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A271JDX1L |
| 300pF(301)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A301GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A301JDX1L |
| 330pF(331)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A331GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A331JDX1L |
| 360pF(361)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A361GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A361JDX1L |
| 390pF(391)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A391GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A391JDX1L |
| 430pF(431)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A431GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A431JDX1L |
| 470pF(471)        | ±2%(G)    |                    |                    |                    | ERB32Q5C2A471GDX1L |
|                   | ±5%(J)    |                    |                    |                    | ERB32Q5C2A471JDX1L |

| LxW [mm]          |           | 3.2x2.5(32)<1210>  |
|-------------------|-----------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             |
| Capacitance       | Tolerance | Part Number        |
| 510pF(511)        | ±2%(G)    | ERB32Q5C1H511GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H511JDX1L |
| 560pF(561)        | ±2%(G)    | ERB32Q5C1H561GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H561JDX1L |
| 620pF(621)        | ±2%(G)    | ERB32Q5C1H621GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H621JDX1L |
| 680pF(681)        | ±2%(G)    | ERB32Q5C1H681GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H681JDX1L |
| 750pF(751)        | ±2%(G)    | ERB32Q5C1H751GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H751JDX1L |
| 820pF(821)        | ±2%(G)    | ERB32Q5C1H821GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H821JDX1L |
| 910pF(911)        | ±2%(G)    | ERB32Q5C1H911GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H911JDX1L |
| 1000pF(102)       | ±2%(G)    | ERB32Q5C1H102GDX1L |
|                   | ±5%(J)    | ERB32Q5C1H102JDX1L |

The part number code is shown in ( ) and Unit is shown in [ ]. <>: EIA [inch] Code

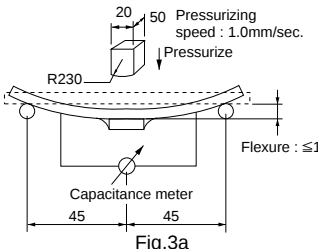
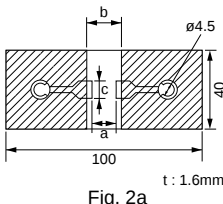
## ERB Series Specifications and Test Methods

| No.                                                                                              | Item                                          |                    | Specifications                                                                                                | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------|---------|-----------|-------|-------|-----|------|-------|-------|-----|------|-------|-----|-----|-----|
| 1                                                                                                | Operating Temperature Range                   |                    | −55 to +125℃                                                                                                  | Reference Temperature: 25℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 2                                                                                                | Rated Voltage                                 |                    | See the previous pages.                                                                                       | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, V <sup>P-P</sup> or V <sup>O-P</sup> , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 3                                                                                                | Appearance                                    |                    | No defects or abnormalities                                                                                   | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 4                                                                                                | Dimensions                                    |                    | Within the specified dimension                                                                                | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 5                                                                                                | Dielectric Strength                           |                    | No defects or abnormalities                                                                                   | No failure should be observed when 300%(*) of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.<br>(*) 300V: 250%, 500V: 200%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 6                                                                                                | Insulation Resistance (I.R.)                  |                    | 1,000,000MΩ min. (C≤470pF)<br>100,000MΩ min. (C>470pF)                                                        | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and standard humidity and within 2 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 7                                                                                                | Capacitance                                   |                    | Within the specified tolerance                                                                                | The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 8                                                                                                | Q                                             |                    | C≤ 220pF : Q≥10,000<br>220pF<C≤ 470pF : Q≥ 5,000<br>470pF<C≤1,000pF : Q≥ 3,000<br>C: Nominal Capacitance (pF) | <table><tr><td>Frequency</td><td>1±0.1MHz</td></tr><tr><td>Voltage</td><td>1±0.2Vrms</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Frequency | 1±0.1MHz        | Voltage | 1±0.2Vrms |       |       |     |      |       |       |     |      |       |     |     |     |
| Frequency                                                                                        | 1±0.1MHz                                      |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| Voltage                                                                                          | 1±0.2Vrms                                     |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 9                                                                                                | Capacitance Temperature Characteristics       | Capacitance Change | Within the specified tolerance (Table A-6)                                                                    | The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.<br><table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>25±2</td></tr></table> | Step      | Temperature (℃) | 1       | 25±2      | 2     | −55±3 | 3   | 25±2 | 4     | 125±3 | 5   | 25±2 |       |     |     |     |
|                                                                                                  |                                               | Step               | Temperature (℃)                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
|                                                                                                  |                                               | 1                  | 25±2                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 2                                                                                                | −55±3                                         |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 3                                                                                                | 25±2                                          |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 4                                                                                                | 125±3                                         |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 5                                                                                                | 25±2                                          |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| Temperature Coefficient                                                                          | Within the specified tolerance (Table A-6)    |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| Capacitance Drift                                                                                | Within ±0.2% or ±0.05pF (Whichever is larger) |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| 10                                                                                               | Adhesive Strength of Termination              |                    | No removal of the terminations or other defects should occur.                                                 | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1 using an eutectic solder.<br>Then apply 10N* force in parallel with the test jig for 10±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>ERB18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>ERB21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>ERB32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr></table>                                                                                     | Type      | a               | b       | c         | ERB18 | 1.0   | 3.0 | 1.2  | ERB21 | 1.2   | 4.0 | 1.65 | ERB32 | 2.2 | 5.0 | 2.9 |
|                                                                                                  |                                               |                    | Type                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | a         | b               | c       |           |       |       |     |      |       |       |     |      |       |     |     |     |
| ERB18                                                                                            | 1.0                                           | 3.0                | 1.2                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| ERB21                                                                                            | 1.2                                           | 4.0                | 1.65                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
| ERB32                                                                                            | 2.2                                           | 5.0                | 2.9                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |
|  <p>Fig.1</p> |                                               |                    |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                 |         |           |       |       |     |      |       |       |     |      |       |     |     |     |

Continued on the following page. 

## ERB Series Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Specifications                                                                                                                                                                                                                                                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|------------------|--------------------|-----------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------|-----------|-----------------------------------------------------|---|------------|----------------------------|------------|----------------------------|------------|-------------|------|--------|------|--------|
| 11                  | Vibration Resistance                                                                                                                                  | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No defects or abnormalities                                                                                                                                                                                                                                       | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       | Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Within the specified tolerance                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       | Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Satisfies the initial value.<br>$C \leq 220\text{pF} : Q \geq 10,000$<br>$220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$<br>$470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$<br>C: Nominal Capacitance (pF)                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| 12                  | Deflection                                                                                                                                            | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No marking defects                                                                                                                                                                                                                                                | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.                                                                                                                                                                                                                   |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| 13                  | Solderability of Termination                                                                                                                          | 95% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Immerse the capacitor in a solution of isopropyl alcohol and rosin (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution for 5±0.5 seconds at 245±5°C. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| 14                  | Resistance to Soldering Heat                                                                                                                          | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                   | Preheat according to the conditions listed in the table below. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours.                                                                                                                                                                                                                                                                                                                  |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       | <table><tr><th>Item</th><th>Specifications</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>Within <math>\pm 2.5\%</math> or <math>\pm 0.25\text{pF}</math> (Whichever is larger)</td></tr><tr><td>Q</td><td><math>C \leq 220\text{pF} : Q \geq 10,000</math><br/><math>220\text{pF} &lt; C \leq 470\text{pF} : Q \geq 5,000</math><br/><math>470\text{pF} &lt; C \leq 1,000\text{pF} : Q \geq 3,000</math></td></tr><tr><td>Dielectric Strength</td><td>No failure</td></tr></table> C: Nominal Capacitance (pF)                                      | Item                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Specifications | Appearance | No marked defect | Capacitance Change | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger) | Q | $C \leq 220\text{pF} : Q \geq 10,000$<br>$220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$<br>$470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ | Dielectric Strength | No failure   | <table><tr><th>Chip Size</th><th>Preheat Condition</th></tr><tr><td>2.0X1.25mm max.</td><td>1minute at 120 to 150°C</td></tr><tr><td>3.2X2.5mm</td><td>Each 1 minute at 100 to 120°C and then 170 to 200°C</td></tr></table> | Chip Size  | Preheat Condition                                                                                                                                                                                                                                                                                          | 2.0X1.25mm max. | 1minute at 120 to 150°C | 3.2X2.5mm | Each 1 minute at 100 to 120°C and then 170 to 200°C |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Specifications                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Appearance          | No marked defect                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Capacitance Change  | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Q                   | $C \leq 220\text{pF} : Q \geq 10,000$<br>$220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$<br>$470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Dielectric Strength | No failure                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Chip Size           | Preheat Condition                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| 2.0X1.25mm max.     | 1minute at 120 to 150°C                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| 3.2X2.5mm           | Each 1 minute at 100 to 120°C and then 170 to 200°C                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| 15                  | Temperature Cycle                                                                                                                                     | The measured and observed characteristics should satisfy the specifications in the following table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                   | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                                                                 |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
|                     |                                                                                                                                                       | <table><tr><th>Item</th><th>Specifications</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>Within <math>\pm 5\%</math> or <math>\pm 0.5\text{pF}</math> (Whichever is larger)</td></tr><tr><td>Q</td><td><math>C \geq 30\text{pF} : Q \geq 350</math><br/><math>10\text{pF} \leq C &lt; 30\text{pF} : Q \geq 275 + \frac{5}{2} \cdot C</math><br/><math>C &lt; 10\text{pF} : Q \geq 200 + 10C</math></td></tr><tr><td>I.R.</td><td>1,000MΩ min.</td></tr><tr><td>Dielectric Strength</td><td>No failure</td></tr></table> C: Nominal Capacitance (pF) | Item                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Specifications | Appearance | No marked defect | Capacitance Change | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)    | Q | $C \geq 30\text{pF} : Q \geq 350$<br>$10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} \cdot C$<br>$C < 10\text{pF} : Q \geq 200 + 10C$    | I.R.                | 1,000MΩ min. | Dielectric Strength                                                                                                                                                                                                          | No failure | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. +0/−3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/−0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>5 max.</td><td>30±3</td><td>5 max.</td></tr></table> | Step            | 1                       | 2         | 3                                                   | 4 | Temp. (°C) | Min. Operating Temp. +0/−3 | Room Temp. | Max. Operating Temp. +3/−0 | Room Temp. | Time (min.) | 30±3 | 5 max. | 30±3 | 5 max. |
|                     |                                                                                                                                                       | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Specifications                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Appearance          | No marked defect                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Capacitance Change  | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Q                   | $C \geq 30\text{pF} : Q \geq 350$<br>$10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} \cdot C$<br>$C < 10\text{pF} : Q \geq 200 + 10C$    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| I.R.                | 1,000MΩ min.                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Dielectric Strength | No failure                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Step                | 1                                                                                                                                                     | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3                                                                                                                                                                                                                                                                 | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Temp. (°C)          | Min. Operating Temp. +0/−3                                                                                                                            | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Max. Operating Temp. +3/−0                                                                                                                                                                                                                                        | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |
| Time (min.)         | 30±3                                                                                                                                                  | 5 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30±3                                                                                                                                                                                                                                                              | 5 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |            |                  |                    |                                                                 |   |                                                                                                                                                       |                     |              |                                                                                                                                                                                                                              |            |                                                                                                                                                                                                                                                                                                            |                 |                         |           |                                                     |   |            |                            |            |                            |            |             |      |        |      |        |

Continued on the following page. ↗

## 6



Apply the 24-hour heat (−10 to +65°C) and humidity (80 to 100%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure.

Temperature (°C) vs. Time (Hours) profile for one 24-hour cycle:

- 0 to 3 hours: Ramp up from 20°C to 65°C. Humidity: 90-98%.
- 3 to 18 hours: Hold at 65°C. Humidity: 90-98%.
- 18 to 21 hours: Ramp down from 65°C to 25°C. Humidity: 80-98%.
- 21 to 24 hours: Hold at 25°C.

The cycle is repeated 10 times, with a 24-hour rest period at room temperature (20°C) between cycles. The graph is labeled "One cycle 24 hours" and "Applied voltage 50Vdc".

| Char.     | Nominal Values<br>(ppm/°C) Note 1 | Capacitance Change from 25°C (%) |       |      |       |      |       |
|-----------|-----------------------------------|----------------------------------|-------|------|-------|------|-------|
|           |                                   | −55                              |       | −30  |       | −10  |       |
|           |                                   | Max.                             | Min.  | Max. | Min.  | Max. | Min.  |
| <b>5C</b> | 0±30                              | 0.58                             | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |

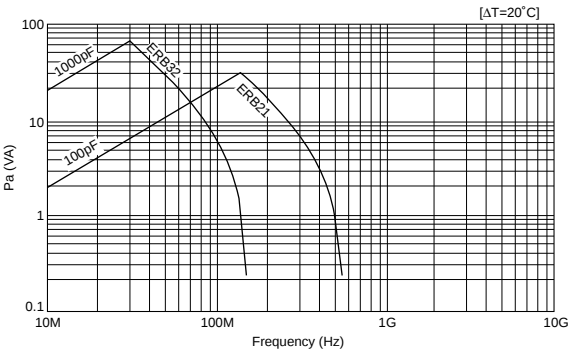
Note 1: Nominal values denote the temperature coefficient within a range of 25 to 125°C (for 5°C)



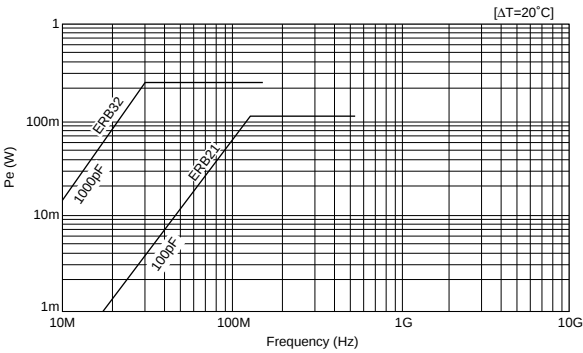
ERB Series Data

 Continued from the preceding page.

■ Allowable Apparent Power - Frequency



■ Allowable Effective Power - Frequency



Chip Monolithic Ceramic Capacitors



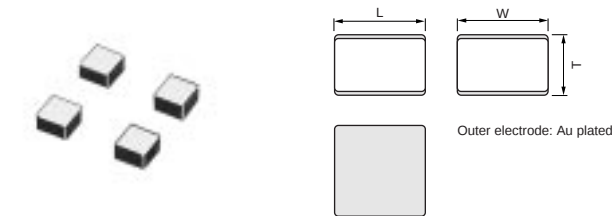
Monolithic Microchip GMA Series

■ Features

- 1. Better micro wave characteristics
- 2. Suitable for by-passing
- 3. High density mounting

■ Applications

- 1. Optical device for telecommunication
- 2. IC, IC packaging built-in
- 3. Measuring equipment



| Part Number | Dimensions (mm) |            |            |
|-------------|-----------------|------------|------------|
|             | L               | W          | T          |
| GMA0D3      | 0.38 ±0.05      | 0.38 ±0.05 | 0.3 ±0.05  |
| GMA05X      | 0.5 ±0.05       | 0.5 ±0.05  | 0.35 ±0.05 |
| GMA085      | 0.8 ±0.05       | 0.8 ±0.05  | 0.5 ±0.1   |

Capacitance Table

7

High Dielectric Constant Type X7R(R7)/X5R(R6) Characteristics

| X            |                     | ex.X: T Dimension [mm]        |                           |            |             |             |                           |            |             |             |  |
|--------------|---------------------|-------------------------------|---------------------------|------------|-------------|-------------|---------------------------|------------|-------------|-------------|--|
| Capacitance  | LxW [mm]            | 0.38x0.38<br>(0D)<br><015015> | 0.5x0.5<br>(05)<br><0202> |            |             |             | 0.8x0.8<br>(08)<br><0303> |            |             |             |  |
|              | Rated Voltage [Vdc] | 10<br>(1A)                    | 100<br>(2A)               | 25<br>(1E) | 10<br>(1A)  | 6.3<br>(0J) | 100<br>(2A)               | 25<br>(1E) | 10<br>(1A)  | 6.3<br>(0J) |  |
|              | TC                  | X7R<br>(R7)                   | X7R<br>(R7)               |            | X5R<br>(R6) |             | X7R<br>(R7)               |            | X5R<br>(R6) |             |  |
| 100pF(101)   |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 150pF(151)   |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 220pF(221)   |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 330pF(331)   |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 470pF(471)   |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 680pF(681)   |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 1000pF(102)  |                     | X                             |                           |            |             |             |                           |            |             |             |  |
| 1500pF(152)  |                     |                               |                           | X          |             |             | 5                         |            |             |             |  |
| 2200pF(222)  |                     |                               |                           | X          |             |             | 5                         |            |             |             |  |
| 3300pF(332)  |                     |                               |                           | X          |             |             | 5                         |            |             |             |  |
| 4700pF(472)  |                     |                               |                           | X          |             |             | 5                         |            |             |             |  |
| 6800pF(682)  |                     |                               |                           |            | X           |             | 5                         |            |             |             |  |
| 10000pF(103) | 3                   |                               |                           |            | X           |             |                           | 5          |             |             |  |
| 15000pF(153) |                     |                               |                           |            | X           |             |                           | 5          |             |             |  |
| 22000pF(223) |                     |                               |                           |            | X           |             |                           | 5          |             |             |  |
| 33000pF(333) |                     |                               |                           |            |             |             |                           |            | 5           |             |  |
| 47000pF(473) |                     |                               |                           |            |             |             |                           |            | 5           |             |  |
| 68000pF(683) |                     |                               |                           |            |             |             |                           |            | 5           |             |  |
| 0.10μF(104)  |                     |                               |                           |            |             | X           |                           |            | 5           |             |  |
| 0.47μF(474)  |                     |                               |                           |            |             |             |                           |            |             | 5           |  |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## High Dielectric Constant Type X7R(R7)/X5R(R6) Characteristics

|                   |           |                       |
|-------------------|-----------|-----------------------|
| LxW [mm]          |           | 0.38x0.38(0D)<015015> |
| Rated Volt. [Vdc] |           | 10(1A)                |
| Capacitance       | Tolerance | Part Number           |
| 10000pF(103)      | ±20%(M)   | GMA0D3R71A103MA01T    |

|                   |           |                    |                    |                    |                     |
|-------------------|-----------|--------------------|--------------------|--------------------|---------------------|
| LxW [mm]          |           | 0.5x0.5(05)<0202>  |                    |                    |                     |
| Rated Volt. [Vdc] |           | 100(2A)            | 25(1E)             | 10(1A)             | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                     |
| 100pF(101)        | ±20%(M)   | GMA05XR72A101MA01T |                    |                    |                     |
| 150pF(151)        | ±20%(M)   | GMA05XR72A151MA01T |                    |                    |                     |
| 220pF(221)        | ±20%(M)   | GMA05XR72A221MA01T |                    |                    |                     |
| 330pF(331)        | ±20%(M)   | GMA05XR72A331MA01T |                    |                    |                     |
| 470pF(471)        | ±20%(M)   | GMA05XR72A471MA01T |                    |                    |                     |
| 680pF(681)        | ±20%(M)   | GMA05XR72A681MA01T |                    |                    |                     |
| 1000pF(102)       | ±20%(M)   | GMA05XR72A102MA01T |                    |                    |                     |
| 1500pF(152)       | ±20%(M)   |                    | GMA05XR71E152MA11T |                    |                     |
| 2200pF(222)       | ±20%(M)   |                    | GMA05XR71E222MA11T |                    |                     |
| 3300pF(332)       | ±20%(M)   |                    | GMA05XR71E332MA11T |                    |                     |
| 4700pF(472)       | ±20%(M)   |                    | GMA05XR71E472MA11T |                    |                     |
| 6800pF(682)       | ±20%(M)   |                    |                    | GMA05XR71A682MA01T |                     |
| 10000pF(103)      | ±20%(M)   |                    |                    | GMA05XR71A103MA01T |                     |
| 15000pF(153)      | ±20%(M)   |                    |                    | GMA05XR71A153MA01T |                     |
| 22000pF(223)      | ±20%(M)   |                    |                    | GMA05XR71A223MA01T |                     |
| 33000pF(333)      | ±20%(M)   |                    |                    |                    |                     |
| 47000pF(473)      | ±20%(M)   |                    |                    |                    |                     |
| 68000pF(683)      | ±20%(M)   |                    |                    |                    |                     |
| 0.10μF(104)       | ±20%(M)   |                    |                    |                    | GMA05XR60J104ME12T* |

|                   |           |                    |                    |                    |                     |
|-------------------|-----------|--------------------|--------------------|--------------------|---------------------|
| LxW [mm]          |           | 0.8x0.8(08)<0303>  |                    |                    |                     |
| Rated Volt. [Vdc] |           | 100(2A)            | 25(1E)             | 10(1A)             | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |                     |
| 1500pF(152)       | ±20%(M)   | GMA085R72A152MA01T |                    |                    |                     |
| 2200pF(222)       | ±20%(M)   | GMA085R72A222MA01T |                    |                    |                     |
| 3300pF(332)       | ±20%(M)   | GMA085R72A332MA01T |                    |                    |                     |
| 4700pF(472)       | ±20%(M)   | GMA085R72A472MA01T |                    |                    |                     |
| 6800pF(682)       | ±20%(M)   | GMA085R72A682MA01T |                    |                    |                     |
| 10000pF(103)      | ±20%(M)   |                    | GMA085R71E103MA11T |                    |                     |
| 15000pF(153)      | ±20%(M)   |                    | GMA085R71E153MA11T |                    |                     |
| 22000pF(223)      | ±20%(M)   |                    | GMA085R71E223MA11T |                    |                     |
| 33000pF(333)      | ±20%(M)   |                    |                    | GMA085R71A333MA01T |                     |
| 47000pF(473)      | ±20%(M)   |                    |                    | GMA085R71A473MA01T |                     |
| 68000pF(683)      | ±20%(M)   |                    |                    | GMA085R71A683MA01T |                     |
| 0.10μF(104)       | ±20%(M)   |                    |                    | GMA085R71A104MA01T |                     |
| 0.47μF(474)       | ±20%(M)   |                    |                    |                    | GMA085R60J474ME12T* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GMA series Specifications and Test Method(2).

(Part Number) **GM** **A** **0D** **3** **R7** **1A** **103** **M** **A01** **T**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Product ID      ② Series  
 ⑤ Temperature Characteristics  
 ⑧ Capacitance Tolerance

③ Dimension (LxW)  
 ⑥ Rated Voltage  
 ⑨ Individual Specification Code

④ Dimension (T)  
 ⑦ Capacitance  
 ⑩ Packaging

Packaging Code in Part Number is a code shows STD Tray.

## GMA Series Specifications and Test Methods(1)

In case Non "\*\*\*" is added in PNs table, please refer to GMA Series Specifications and Test Methods (1).  
 In case "\*\*\*" is added in PNs table, please refer to GMA Series Specifications and Test Methods (2).

| No.                 | Item                                                        |                    | Specifications                                              | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|---------------------|-------------------------------------------------------------|--------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------|------------|-----------|---|-----------|----------------------------|------------|----------------------------|------------|-------------|------|--------|------|--------|
| 1                   | Operating Temperature Range                                 |                    | R7: −55 to +125℃                                            | Reference Temperature: 25℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 2                   | Rated Voltage                                               |                    | See the previous pages.                                     | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 3                   | Appearance                                                  |                    | No defects or abnormalities                                 | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 4                   | Dimensions                                                  |                    | Within the specified dimensions                             | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 5                   | Dielectric Strength                                         |                    | No defects or abnormalities                                 | No failure should be observed when a voltage of 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 6                   | Insulation Resistance                                       |                    | More than 10,000MΩ or 500ΩF (Whichever is smaller)          | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 7                   | Capacitance                                                 |                    | Within the specified tolerance                              | The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table. <table><tr><td>Frequency</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>1±0.2Vrms</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Frequency       | 1±0.1kHz                   | Voltage    | 1±0.2Vrms |   |           |                            |            |                            |            |             |      |        |      |        |
| Frequency           | 1±0.1kHz                                                    |                    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| Voltage             | 1±0.2Vrms                                                   |                    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 8                   | Dissipation Factor (D.F.)                                   |                    | R7: W.V.: 25V min.; 0.025 max.<br>W.V.: 16V/10V; 0.035 max. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 9                   | Capacitance Temperature Characteristics                     | No bias            | R7: Within +/−15% (−55 to +125℃)                            | The capacitance change should be measured after 5min. at each specified temp. stage.<br>•The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.* <table><tr><td>Step</td><td>Temperature (℃)</td></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3</td></tr></table><br>*Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150 +0/−10℃ for one hour and then let sit for 24±2 hours at room temperature.<br>Perform the initial measurement.                                                     | Step            | Temperature (℃)            | 1          | 25±2      | 2 | −55±3     | 3                          | 25±2       | 4                          | 125±3      |             |      |        |      |        |
|                     |                                                             |                    |                                                             | Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Temperature (℃) |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             |                    |                                                             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 25±2            |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             |                    |                                                             | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | −55±3           |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             |                    |                                                             | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 25±2            |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 4                   | 125±3                                                       |                    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 10                  | Mechanical Strength                                         | Bond Strength      | Pull force: 0.03N min.                                      | MIL-STD-883 Method 2011 Condition D<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 25μm (0.001 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             | Die Shear Strength | Die Shear force: 2N min.                                    | MIL-STD-883 Method 2019<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 11                  | Vibration Resistance                                        | Appearance         | No defects or abnormalities                                 | Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude: 1.5 mm (0.06 inch) max. total excursion.<br>Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             | Capacitance        | Within the specified tolerance                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             | D.F.               | R7: W.V.: 25V min.; 0.025 max.<br>W.V.: 16V/10V; 0.035 max. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| 12                  | Temperature Cycle                                           | Appearance         | No defects or abnormalities                                 | The capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150+0/−10℃, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11) and conduct the five cycles according to the temperatures and time shown in the following table. Set it for 24±2 hours at room temperature, then measure. <table><tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Temp. (℃)</td><td>Min. Operating Temp. +0/−3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/−0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table> | Step            | 1                          | 2          | 3         | 4 | Temp. (℃) | Min. Operating Temp. +0/−3 | Room Temp. | Max. Operating Temp. +3/−0 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
|                     |                                                             | Step               | 1                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2               | 3                          | 4          |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             | Temp. (℃)          | Min. Operating Temp. +0/−3                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Room Temp.      | Max. Operating Temp. +3/−0 | Room Temp. |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             | Time (min.)        | 30±3                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2 to 3          | 30±3                       | 2 to 3     |           |   |           |                            |            |                            |            |             |      |        |      |        |
|                     |                                                             | Capacitance Change | R7: Within ±7.5%                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| D.F.                | R7: W.V.: 25V min.; 0.025 max.<br>W.V.: 16V/10V; 0.035 max. |                    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| I.R.                | More than 10,000MΩ or 500ΩF (Whichever is smaller)          |                    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |
| Dielectric Strength | No defects                                                  |                    |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                            |            |           |   |           |                            |            |                            |            |             |      |        |      |        |

Mounting for testing: The capacitors should be mounted on the substrate as shown below using die bonding and wire bonding when tests No.11 to 15 are performed.

Continued on the following page. 



## GMA Series Specifications and Test Methods(2)

In case Non "\*\*\*" is added in PNs table, please refer to GMA Series Specifications and Test Methods (1).  
 In case "\*\*\*" is added in PNs table, please refer to GMA Series Specifications and Test Methods (2).

| No.               | Item                                    |                     | Specifications                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|-------------------|-----------------------------------------|---------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|-------------------|----------|-------------|------------|----------------------------|------------|----------------------------|------------|-------------|------|
| 1                 | Operating Temperature Range             |                     | R6 : -55°C to 85°C                | Reference Temperature : 25°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 2                 | Rated Voltage                           |                     | See the previous pages.           | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, V <sup>P-P</sup> or V <sup>O-P</sup> , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 3                 | Appearance                              |                     | No defects or abnormalities.      | Visual inspection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 4                 | Dimensions                              |                     | Within the specified dimensions.  | Using calipers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 5                 | Dielectric Strength                     |                     | No defects or abnormalities.      | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 6                 | Insulation Resistance                   |                     | More than 50Ω · F                 | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 1 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 7                 | Capacitance                             |                     | Within the specified tolerance.   | The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 8                 | Dissipation Factor (D.F.)               |                     | R6 : 0.1 max.                     | <table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>C≤10μF (6.3Vmax.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Capacitance                                                                                                                                                                                                                                                                                                | Frequency        | Voltage | C≤10μF (6.3Vmax.) | 1±0.1kHz | 0.5±0.1Vrms |            |                            |            |                            |            |             |      |
| Capacitance       | Frequency                               | Voltage             |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| C≤10μF (6.3Vmax.) | 1±0.1kHz                                | 0.5±0.1Vrms         |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 9                 | Capacitance Temperature Characteristics | No bias             | R6 : Within ±15% (-55°C to +85°C) | <p>The capacitance change should be measured after 5min. at each specified temp. stage.</p> <p>The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.*</p> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>-55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>85±3</td></tr></table> <p>*Initial measurement for high dielectric constant type<br/>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature.<br/>Perform the initial measurement.</p> | Step                                                                                                                                                                                                                                                                                                       | Temperature (°C) | 1       | 25±2              | 2        | -55±3       | 3          | 25±2                       | 4          | 85±3                       |            |             |      |
| Step              | Temperature (°C)                        |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 1                 | 25±2                                    |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 2                 | -55±3                                   |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 3                 | 25±2                                    |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 4                 | 85±3                                    |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 10                | Mechanical Strength                     | Bond Strength       | Pull force : 0.03N min.           | MIL-STD-883 Method 2011 Condition D<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 25μm (0.001 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | Die Shear Strength  | Die Shear force : 2N min.         | MIL-STD-883 Method 2019<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 11                | Vibration Resistance                    | Appearance          | No defects or abnormalities.      | Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude : 1.5 mm (0.06 inch) max. total excursion.<br>Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | Capacitance         | Within the specified tolerance.   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | D.F.                | R6 : 0.1 max.                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| 12                | Temperature Sudden Change               | Appearance          | No defects or abnormalities.      | The capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150+0/-10°C, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11) and conduct the five cycles according to the temperatures and time shown in the following table. Set it for 48±4 hours at room temperature, then measure.                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | Capacitance Change  | R6 : Within ±7.5%                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | D.F.                | R6 : 0.1 max.                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | I.R.                | More than 50Ω · F                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
|                   |                                         | Dielectric Strength | No defects                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. +0/-3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/-0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table> | Step             | 1       | 2                 | 3        | 4           | Temp. (°C) | Min. Operating Temp. +0/-3 | Room Temp. | Max. Operating Temp. +3/-0 | Room Temp. | Time (min.) | 30±3 |
| Step              | 1                                       | 2                   | 3                                 | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| Temp. (°C)        | Min. Operating Temp. +0/-3              | Room Temp.          | Max. Operating Temp. +3/-0        | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |
| Time (min.)       | 30±3                                    | 2 to 3              | 30±3                              | 2 to 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                            |                  |         |                   |          |             |            |                            |            |                            |            |             |      |

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding and wire bonding when tests No.11 to 14 are performed.

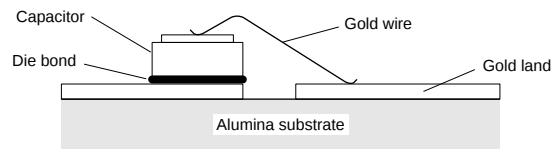
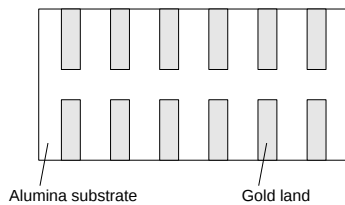
Continued on the following page. 

## GMA Series Specifications and Test Methods(2)

Continued from the preceding page. In case Non "\*" is added in PNs table, please refer to GMA Series Specifications and Test Methods (1).  
 In case "\*" is added in PNs table, please refer to GMA Series Specifications and Test Methods (2).

| No. | Item                                    | Specifications     | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----|-----------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13  | High Temperature High Humidity (Steady) | Appearance         | Apply the rated voltage for 500±12 hours at 40±2°C, in 90 to 95% humidity and set it for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.<br><br>• Initial measurement<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.<br><br>• Measurement after test<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.                     |
|     |                                         | Capacitance Change |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|     |                                         | D.F.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|     |                                         | I.R.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 14  | Durability                              | Appearance         | Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure.<br>The charge/ discharge current is less than 50mA.<br><br>• Initial measurement<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.<br><br>• Measurement after test<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure. |
|     |                                         | Capacitance Change |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|     |                                         | D.F.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|     |                                         | I.R.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding and wire bonding when tests No.11 to 14 are performed.



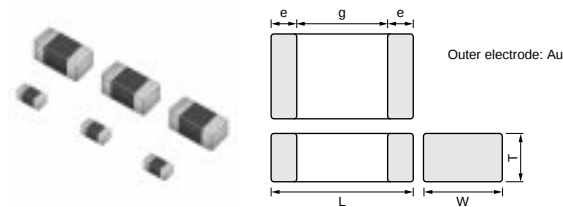
# Chip Monolithic Ceramic Capacitors



## for Bonding GMD Series

### ■ Features

- 1. Small chip size (LxWxT: 0.6x0.3x0.3, 1.0x0.5x0.5mm)
- 2. Available for Wire/Die bonding due to Gold termination.
- 3. Suitable for Optical device for telecommunication, IC packaging built-in.



### ■ Applications

- 1. Optical device for telecommunication
- 2. IC, IC packaging built-in

| Part Number | Dimensions (mm) |          |          |              |        |
|-------------|-----------------|----------|----------|--------------|--------|
|             | L               | W        | T        | e            | g min. |
| GMD033      | 0.6±0.03        | 0.3±0.03 | 0.3±0.03 | 0.12 to 0.22 | 0.16   |
| GMD155      | 1.0±0.05        | 0.5±0.05 | 0.5±0.05 | 0.15 to 0.35 | 0.3    |

## High Dielectric Constant Type X7R(R7)/X5R(R6) Characteristics

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

## High Dielectric Constant Type X7R(R7) Characteristics

| LxW [mm]          |           | 0.6x0.3(03)<0201>  |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 25(1E)             | 16(1C)             | 10(1A)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 100pF(101)        | ±10%(K)   | GMD033R71E101KA01D |                    |                    |
| 120pF(121)        | ±10%(K)   | GMD033R71E121KA01D |                    |                    |
| 150pF(151)        | ±10%(K)   | GMD033R71E151KA01D |                    |                    |
| 180pF(181)        | ±10%(K)   | GMD033R71E181KA01D |                    |                    |
| 220pF(221)        | ±10%(K)   | GMD033R71E221KA01D |                    |                    |
| 270pF(271)        | ±10%(K)   | GMD033R71E271KA01D |                    |                    |
| 330pF(331)        | ±10%(K)   | GMD033R71E331KA01D |                    |                    |
| 390pF(391)        | ±10%(K)   | GMD033R71E391KA01D |                    |                    |
| 470pF(471)        | ±10%(K)   | GMD033R71E471KA01D |                    |                    |
| 560pF(561)        | ±10%(K)   | GMD033R71E561KA01D |                    |                    |
| 680pF(681)        | ±10%(K)   | GMD033R71E681KA01D |                    |                    |
| 820pF(821)        | ±10%(K)   | GMD033R71E821KA01D |                    |                    |
| 1000pF(102)       | ±10%(K)   | GMD033R71E102KA01D |                    |                    |
| 1200pF(122)       | ±10%(K)   | GMD033R71E122KA01D |                    |                    |
| 1500pF(152)       | ±10%(K)   | GMD033R71E152KA01D |                    |                    |
| 1800pF(182)       | ±10%(K)   |                    | GMD033R71C182KA11D |                    |
| 2200pF(222)       | ±10%(K)   |                    | GMD033R71C222KA11D |                    |
| 2700pF(272)       | ±10%(K)   |                    | GMD033R71C272KA11D |                    |
| 3300pF(332)       | ±10%(K)   |                    | GMD033R71C332KA11D |                    |
| 3900pF(392)       | ±10%(K)   |                    |                    | GMD033R71A392KA01D |
| 4700pF(472)       | ±10%(K)   |                    |                    | GMD033R71A472KA01D |
| 5600pF(562)       | ±10%(K)   |                    |                    | GMD033R71A562KA01D |
| 6800pF(682)       | ±10%(K)   |                    |                    | GMD033R71A682KA01D |
| 8200pF(822)       | ±10%(K)   |                    |                    | GMD033R71A822KA01D |
| 10000pF(103)      | ±10%(K)   |                    |                    | GMD033R71A103KA01D |

The part number code is shown in ( ) and Unit is shown in [ ].    < >: EIA [inch] Code

High Dielectric Constant Type X7R(R7) Characteristics

| LxW [mm]          |           | 1.0x0.5(15)<0402>  |                    |                    |
|-------------------|-----------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |           | 50(1H)             | 25(1E)             | 16(1C)             |
| Capacitance       | Tolerance | Part Number        |                    |                    |
| 220pF(221)        | ±10%(K)   | GMD155R71H221KA01D |                    |                    |
| 270pF(271)        | ±10%(K)   | GMD155R71H271KA01D |                    |                    |
| 330pF(331)        | ±10%(K)   | GMD155R71H331KA01D |                    |                    |
| 390pF(391)        | ±10%(K)   | GMD155R71H391KA01D |                    |                    |
| 470pF(471)        | ±10%(K)   | GMD155R71H471KA01D |                    |                    |
| 560pF(561)        | ±10%(K)   | GMD155R71H561KA01D |                    |                    |
| 680pF(681)        | ±10%(K)   | GMD155R71H681KA01D |                    |                    |
| 820pF(821)        | ±10%(K)   | GMD155R71H821KA01D |                    |                    |
| 1000pF(102)       | ±10%(K)   | GMD155R71H102KA01D |                    |                    |
| 1200pF(122)       | ±10%(K)   | GMD155R71H122KA01D |                    |                    |
| 1500pF(152)       | ±10%(K)   | GMD155R71H152KA01D |                    |                    |
| 1800pF(182)       | ±10%(K)   | GMD155R71H182KA01D |                    |                    |
| 2200pF(222)       | ±10%(K)   | GMD155R71H222KA01D |                    |                    |
| 2700pF(272)       | ±10%(K)   | GMD155R71H272KA01D |                    |                    |
| 3300pF(332)       | ±10%(K)   | GMD155R71H332KA01D |                    |                    |
| 3900pF(392)       | ±10%(K)   | GMD155R71H392KA01D |                    |                    |
| 4700pF(472)       | ±10%(K)   | GMD155R71H472KA01D |                    |                    |
| 5600pF(562)       | ±10%(K)   |                    | GMD155R71E562KA01D |                    |
| 6800pF(682)       | ±10%(K)   |                    | GMD155R71E682KA01D |                    |
| 8200pF(822)       | ±10%(K)   |                    | GMD155R71E822KA01D |                    |
| 10000pF(103)      | ±10%(K)   |                    | GMD155R71E103KA01D |                    |
| 12000pF(123)      | ±10%(K)   |                    | GMD155R71E123KA01D |                    |
| 15000pF(153)      | ±10%(K)   |                    | GMD155R71E153KA01D |                    |
| 18000pF(183)      | ±10%(K)   |                    | GMD155R71E183KA01D |                    |
| 22000pF(223)      | ±10%(K)   |                    | GMD155R71E223KA01D |                    |
| 27000pF(273)      | ±10%(K)   |                    | GMD155R71E273KA11D |                    |
| 33000pF(333)      | ±10%(K)   |                    | GMD155R71E333KA11D |                    |
| 39000pF(393)      | ±10%(K)   |                    | GMD155R71E393KA11D |                    |
| 47000pF(473)      | ±10%(K)   |                    | GMD155R71E473KA11D |                    |
| 56000pF(563)      | ±10%(K)   |                    |                    | GMD155R71C563KA11D |
| 68000pF(683)      | ±10%(K)   |                    |                    | GMD155R71C683KA11D |
| 82000pF(823)      | ±10%(K)   |                    |                    | GMD155R71C823KA11D |
| 0.10μF(104)       | ±10%(K)   |                    |                    | GMD155R71C104KA11D |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

(Part Number) GM D 15 5 R7 1H 221 K A01 D

①Product ID

②Series

③Dimension (LxW)

④Dimension (T)

⑤Temperature Characteristics

⑥Rated Voltage

⑦Capacitance

⑧Capacitance Tolerance

⑨Individual Specification Code

⑩Packaging

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.

## High Dielectric Constant Type X5R(R6) Characteristics

| LxW [mm]          |           | 0.6x0.3(03)<0201>   |                     | 1.0x0.5(15)<0402> |                     |
|-------------------|-----------|---------------------|---------------------|-------------------|---------------------|
| Rated Volt. [Vdc] |           | 6.3(0J)             |                     | 10(1A)            | 6.3(0J)             |
| Capacitance       | Tolerance | Part Number         |                     |                   |                     |
| 56000pF(563)      | ±10%(K)   | GMD033R60J563KE11D* |                     |                   |                     |
| 68000pF(683)      | ±10%(K)   | GMD033R60J683KE11D* |                     |                   |                     |
| 82000pF(823)      | ±10%(K)   | GMD033R60J823KE11D* |                     |                   |                     |
| 0.10μF(104)       | ±10%(K)   | GMD033R60J104KE11D* |                     |                   |                     |
| 0.12μF(124)       | ±10%(K)   |                     | GMD155R61A124KE12D* |                   |                     |
| 0.15μF(154)       | ±10%(K)   |                     | GMD155R61A154KE12D* |                   |                     |
| 0.18μF(184)       | ±10%(K)   |                     | GMD155R61A184KE12D* |                   |                     |
| 0.22μF(224)       | ±10%(K)   |                     | GMD155R61A224KE12D* |                   |                     |
| 0.27μF(274)       | ±10%(K)   |                     | GMD155R61A274KE11D* |                   |                     |
| 0.33μF(334)       | ±10%(K)   |                     | GMD155R61A334KE11D* |                   |                     |
| 0.39μF(394)       | ±10%(K)   |                     | GMD155R61A394KE11D* |                   |                     |
| 0.47μF(474)       | ±10%(K)   |                     | GMD155R61A474KE11D* |                   |                     |
| 1.0μF(105)        | ±10%(K)   |                     |                     |                   | GMD155R60J105KE11D* |

The part number code is shown in ( ) and Unit is shown in [ ]. < >: EIA [inch] Code

\*: Please refer to GMD series Specifications and Test Method(2).

## GMD Series Specifications and Test Methods (1)

In case Non "\*" is added in PNs table, please refer to GMD Series Specifications and Test Methods (1).  
 In case "\*" is added in PNs table, please refer to GMD Series Specifications and Test Methods (2).

| No.         | Item                                    |                     | Specifications                                                | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|-------------|-----------------------------------------|---------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|---------|-----------|---|------------|---------------------------|------------|----------------------------|------------|-------------|--------|--------|--------|--------|
| 1           | Operating Temperature Range             |                     | R7 : -55°C to 125°C                                           | Reference Temperature : 25°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 2           | Rated Voltage                           |                     | See the previous pages.                                       | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, V <sup>P-P</sup> or V <sup>O-P</sup> , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 3           | Appearance                              |                     | No defects or abnormalities.                                  | Visual inspection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 4           | Dimensions                              |                     | Within the specified dimensions.                              | Using calipers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 5           | Dielectric Strength                     |                     | No defects or abnormality.                                    | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 6           | Insulation Resistance                   |                     | More than 10,000MΩ or 500Ω · F (Whichever is smaller)         | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 7           | Capacitance                             |                     | Within the specified tolerance.                               | The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 8           | Dissipation Factor (D.F.)               |                     | R7 :<br>W.V. 25Vmin. : 0.025 max.<br>W.V. 16/10V : 0.035 max. | <table><tr><td>Frequency</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>1±0.2Vrms</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Frequency | 1±0.1kHz         | Voltage | 1±0.2Vrms |   |            |                           |            |                            |            |             |        |        |        |        |
| Frequency   | 1±0.1kHz                                |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| Voltage     | 1±0.2Vrms                               |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 9           | Capacitance Temperature Characteristics | No bias             | R7 : Within ±15% (-55°C to +125°C)                            | <p>The capacitance change should be measured after 5min. at each specified temp. stage.</p> <p>The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.*</p> <table><tr><td>Step</td><td>Temperature (°C)</td></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>-55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3</td></tr></table> <p>*Initial measurement for high dielectric constant type<br/>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature.<br/>Perform the initial measurement.</p> | Step      | Temperature (°C) | 1       | 25±2      | 2 | -55±3      | 3                         | 25±2       | 4                          | 125±3      |             |        |        |        |        |
| Step        | Temperature (°C)                        |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 1           | 25±2                                    |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 2           | -55±3                                   |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 3           | 25±2                                    |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 4           | 125±3                                   |                     |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 10          | Mechanical Strength                     | Bond Strength       | Pull force : 0.03N min.                                       | MIL-STD-883 Method 2011 Condition D<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 25mm (0.001 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | Die Shear Strength  | Die Shear force : 2N min.                                     | MIL-STD-883 Method 2019<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 11          | Vibration Resistance                    | Appearance          | No defects or abnormalities.                                  | Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude : 1.5 mm (0.06 inch) max. total excursion.<br>Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | Capacitance         | Within the specified tolerance.                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | D.F.                | R7 :<br>W.V. 25Vmin. : 0.025 max.<br>W.V. 16/10V : 0.035 max. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| 12          | Temperature Cycle                       | Appearance          | No defects or abnormalities.                                  | The capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150+0/-10°C, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11) and conduct the five cycles according to the temperatures and time shown in the following table. Set it for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                                                        |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | Capacitance Change  | R7 : Within ±7.5%                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | D.F.                | R7 :<br>W.V. 25Vmin. : 0.025 max.<br>W.V. 16/10V : 0.035 max. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | I.R.                | More than 10,000MΩ or 500Ω · F (Whichever is smaller)         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         | Dielectric Strength | No defects                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
|             |                                         |                     |                                                               | <table><tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp.+0/-3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/-0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30+/-3</td><td>2 to 3</td><td>30+/-3</td><td>2 to 3</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                               | Step      | 1                | 2       | 3         | 4 | Temp. (°C) | Min. Operating Temp.+0/-3 | Room Temp. | Max. Operating Temp. +3/-0 | Room Temp. | Time (min.) | 30+/-3 | 2 to 3 | 30+/-3 | 2 to 3 |
| Step        | 1                                       | 2                   | 3                                                             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| Temp. (°C)  | Min. Operating Temp.+0/-3               | Room Temp.          | Max. Operating Temp. +3/-0                                    | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |
| Time (min.) | 30+/-3                                  | 2 to 3              | 30+/-3                                                        | 2 to 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                  |         |           |   |            |                           |            |                            |            |             |        |        |        |        |

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding. when tests No.11 to 15 are performed.

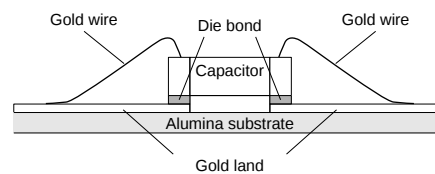
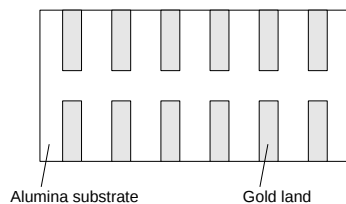
Continued on the following page. 

## GMD Series Specifications and Test Methods (1)

In case Non "\*\*\*\*" is added in PNs table, please refer to GMD Series Specifications and Test Methods (1).  
In case "\*\*\*\*" is added in PNs table, please refer to GMD Series Specifications and Test Methods (2).

| No. | Item                        | Specifications     | Test Method                                                            |
|-----|-----------------------------|--------------------|------------------------------------------------------------------------|
| 13  | Humidity<br>(Steady State)  | Appearance         | No defects or abnormalities.                                           |
|     |                             | Capacitance Change | R7 : Within $\pm 12.5\%$                                               |
|     |                             | D.F.               | R7 :<br>W.V. 25Vmin. : 0.05 max.<br>W.V. 16/10V : 0.05 max.            |
|     |                             | I.R.               | More than 1,000M $\Omega$ or 50 $\Omega$ · F<br>(Whichever is smaller) |
| 14  | Humidity<br>Load            | Appearance         | No defects or abnormalities.                                           |
|     |                             | Capacitance Change | R7 : Within $\pm 12.5\%$                                               |
|     |                             | D.F.               | R7 :<br>W.V. 25Vmin. : 0.05 max.<br>W.V. 16/10V : 0.05 max.            |
|     |                             | I.R.               | More than 500M $\Omega$ or 25 $\Omega$ · F<br>(Whichever is smaller)   |
| 15  | High<br>Temperature<br>Load | Appearance         | No defects or abnormalities.                                           |
|     |                             | Capacitance Change | R7 : Within $\pm 12.5\%$                                               |
|     |                             | D.F.               | R7 :<br>W.V. 25Vmin. : 0.05 max.<br>W.V. 16/10V : 0.05 max.            |
|     |                             | I.R.               | More than 1,000M $\Omega$ or 50 $\Omega$ · F<br>(Whichever is smaller) |

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding. when tests No.11 to 15 are performed.



## GMD Series Specifications and Test Methods (2)

In case Non "\*\*\*" is added in PNs table, please refer to GMD Series Specifications and Test Methods (1).  
 In case "\*\*\*" is added in PNs table, please refer to GMD Series Specifications and Test Methods (2).

| No.                | Item                                    |                     | Specifications                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|--------------------|-----------------------------------------|---------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|---------|--------------------|----------|-------------|---------------------------|------------|----------------------------|------------|-------------|------|--------|------|--------|
| 1                  | Operating Temperature Range             |                     | R6 : -55°C to 85°C                | Reference Temperature : 25°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 2                  | Rated Voltage                           |                     | See the previous pages.           | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, V <sup>P-P</sup> or V <sup>O-P</sup> , whichever is larger, should be maintained within the rated voltage range.                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 3                  | Appearance                              |                     | No defects or abnormalities.      | Visual inspection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 4                  | Dimensions                              |                     | Within the specified dimensions.  | Using calipers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 5                  | Dielectric Strength                     |                     | No defects or abnormalities.      | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 6                  | Insulation Resistance                   |                     | More than 50Ω · F                 | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 1 minutes of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 7                  | Capacitance                             |                     | Within the specified tolerance.   | The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 8                  | Dissipation Factor (D.F.)               |                     | R6 : 0.1 max.                     | <table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>C≤10μF (10Vmin.)*1</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>C≤10μF (6.3Vmax.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr></table><br>*1 GMD155 R6 1A 124 to 224 are applied to 0.5±0.1 Vrms.                                                                                                                                                                                                                                                                                                                                                                                                 | Capacitance | Frequency        | Voltage | C≤10μF (10Vmin.)*1 | 1±0.1kHz | 1.0±0.2Vrms | C≤10μF (6.3Vmax.)         | 1±0.1kHz   | 0.5±0.1Vrms                |            |             |      |        |      |        |
| Capacitance        | Frequency                               | Voltage             |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| C≤10μF (10Vmin.)*1 | 1±0.1kHz                                | 1.0±0.2Vrms         |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| C≤10μF (6.3Vmax.)  | 1±0.1kHz                                | 0.5±0.1Vrms         |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 9                  | Capacitance Temperature Characteristics | No bias             | R6 : Within ±15% (-55°C to +85°C) | <p>The capacitance change should be measured after 5min. at each specified temp. stage.</p> <p>The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.*</p> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>-55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>85±3</td></tr></table> <p>*Initial measurement for high dielectric constant type<br/>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature.<br/>Perform the initial measurement.</p> | Step        | Temperature (°C) | 1       | 25±2               | 2        | -55±3       | 3                         | 25±2       | 4                          | 85±3       |             |      |        |      |        |
| Step               | Temperature (°C)                        |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 1                  | 25±2                                    |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 2                  | -55±3                                   |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 3                  | 25±2                                    |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 4                  | 85±3                                    |                     |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 10                 | Mechanical Strength                     | Bond Strength       | Pull force : 0.03N min.           | MIL-STD-883 Method 2011 Condition D<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 25μm (0.001 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | Die Shear Strength  | Die Shear force : 2N min.         | MIL-STD-883 Method 2019<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 11                 | Vibration Resistance                    | Appearance          | No defects or abnormalities.      | Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude : 1.5 mm (0.06 inch) max. total excursion.<br>Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | Capacitance         | Within the specified tolerance.   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | D.F.                | R6 : 0.1 max.                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| 12                 | Temperature Sudden Change               | Appearance          | No defects or abnormalities.      | The capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150+0/-10°C, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11) and conduct the five cycles according to the temperatures and time shown in the following table. Set it for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                                                       |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | Capacitance Change  | R6 : Within ±7.5%                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | D.F.                | R6 : 0.1 max.                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | I.R.                | More than 50Ω · F                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         | Dielectric Strength | No defects                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
|                    |                                         |                     |                                   | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp.+0/-3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/-0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                  | Step        | 1                | 2       | 3                  | 4        | Temp. (°C)  | Min. Operating Temp.+0/-3 | Room Temp. | Max. Operating Temp. +3/-0 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
| Step               | 1                                       | 2                   | 3                                 | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| Temp. (°C)         | Min. Operating Temp.+0/-3               | Room Temp.          | Max. Operating Temp. +3/-0        | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |
| Time (min.)        | 30±3                                    | 2 to 3              | 30±3                              | 2 to 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |         |                    |          |             |                           |            |                            |            |             |      |        |      |        |

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding. when tests No.11 to 14 are performed.

Continued on the following page. 

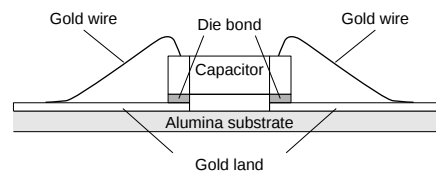
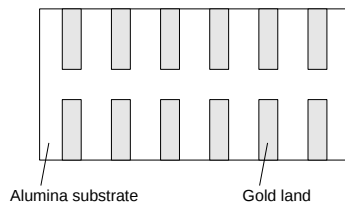
## GMD Series Specifications and Test Methods (2)

Continued from the preceding page.

In case Non "" is added in PNs table, please refer to GMD Series Specifications and Test Methods (1).  
 In case "" is added in PNs table, please refer to GMD Series Specifications and Test Methods (2).

| No. | Item                                          | Specifications     | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----|-----------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13  | High Temperature<br>High Humidity<br>(Steady) | Appearance         | Apply the rated voltage for 500±12 hours at 40±2°C, in 90 to 95% humidity and set it for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.<br><br>• Initial measurement<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.<br><br>• Measurement after test<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.                                                                              |
|     |                                               | Capacitance Change |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                               | D.F.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                               | I.R.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 14  | Durability                                    | Appearance         | Apply 150%*2 of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure.<br>The charge/ discharge current is less than 50mA.<br><br>*2 GMD155 R6 1A 274 to 474 are applied to 120%.<br><br>• Initial measurement<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.<br><br>• Measurement after test<br>Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure. |
|     |                                               | Capacitance Change |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                               | D.F.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                               | I.R.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding. when tests No.11 to 14 are performed.



## Package

### ■ Minimum Quantity Guide

| Part Number         |       | Dimensions (mm) |      |              | Quantity (pcs.)      |                      |                      |               |                      |                      |
|---------------------|-------|-----------------|------|--------------|----------------------|----------------------|----------------------|---------------|----------------------|----------------------|
|                     |       |                 |      |              | ø180mm Reel          |                      | ø330mm Reel          |               | Bulk Case            | Bulk Bag             |
| Packaging Code      |       | L               | W    | T            | Paper Tape           | Embossed Tape        | Paper Tape           | Embossed Tape |                      |                      |
|                     |       |                 |      |              | D                    | L                    | J                    | K             | C                    | Bulk : B<br>Tray : T |
| For General Purpose | GRM02 | 0.4             | 0.2  | 0.2          | 20,000 <sup>1)</sup> | 40,000 <sup>1)</sup> | -                    | -             | -                    | 1,000                |
|                     | GRM03 | 0.6             | 0.3  | 0.3          | 15,000               | -                    | 50,000               | -             | -                    | 1,000                |
|                     | GRM15 | 1.0             | 0.5  | 0.25/0.3     | 10,000               | -                    | 50,000               | -             | -                    | 1,000                |
|                     |       |                 |      | 0.5          | 10,000               | -                    | 50,000               | -             | 50,000               | 1,000                |
|                     | GRM18 | 1.6             | 0.8  | 0.5          | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     |       |                 |      | 0.8          | 4,000                | -                    | 10,000               | -             | 15,000 <sup>2)</sup> | 1,000                |
|                     | GRM21 | 2.0             | 1.25 | 0.6          | 4,000                | -                    | 10,000               | -             | 10,000               | 1,000                |
|                     |       |                 |      | 0.85         | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     |       |                 |      | 1.0/1.25     | -                    | 3,000                | -                    | 10,000        | 5,000 <sup>2)</sup>  | 1,000                |
|                     | GRM31 | 3.2             | 1.6  | 0.6/0.85     | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     |       |                 |      | 1.15         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 1.6          | -                    | 2,000                | -                    | 6,000         | -                    | 1,000                |
|                     | GRM32 | 3.2             | 2.5  | 0.85         | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     |       |                 |      | 1.15         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 1.35         | -                    | 2,000                | -                    | 8,000         | -                    | 1,000                |
|                     |       |                 |      | 1.6          | -                    | 2,000                | -                    | 6,000         | -                    | 1,000                |
|                     |       |                 |      | 1.8/2.0      | -                    | 1,000                | -                    | 4,000         | -                    | 1,000                |
|                     | GRM43 | 4.5             | 3.2  | 1.15         | -                    | 1,000                | -                    | 5,000         | -                    | 1,000                |
|                     |       |                 |      | 1.35/1.6     | -                    | 1,000                | -                    | 4,000         | -                    | 1,000                |
|                     |       |                 |      | 1.8/2.0      | -                    | 500                  | -                    | 2,000         | -                    | 1,000                |
|                     |       |                 |      | 2.5          | -                    | 500                  | -                    | 1,500         | -                    | 500                  |
|                     |       |                 |      | 2.8          | -                    | 500                  | -                    | 1,500         | -                    | 500                  |
|                     | GRM55 | 5.7             | 5.0  | 1.15         | -                    | 1,000                | -                    | 5,000         | -                    | 1,000                |
|                     |       |                 |      | 1.35/1.6     | -                    | 1,000                | -                    | 4,000         | -                    | 1,000                |
|                     |       |                 |      | 2.5          | -                    | 500                  | -                    | 2,000         | -                    | 500                  |
|                     |       |                 |      | 3.2          | -                    | 300                  | -                    | 1,500         | -                    | 500                  |
| High Power Type     | GJM03 | 0.6             | 0.3  | 0.3          | 15,000               | -                    | 50,000               | -             | -                    | 1,000                |
|                     | GJM15 | 1.0             | 0.5  | 0.5          | 10,000               | -                    | 50,000               | -             | 50,000               | 1,000                |
| High Frequency      | QQM18 | 1.6             | 0.8  | 0.7/0.8      | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     | QQM21 | 2.0             | 1.25 | 0.85         | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     | ERB18 | 1.6             | 0.8  | 0.9 max.     | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     | ERB21 | 2.0             | 1.25 | 1.35 max.    | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     | ERB32 | 3.2             | 2.5  | 1.7 max.     | -                    | 2,000                | -                    | 8,000         | -                    | 1,000                |
| Microchip           | GMA0D | 0.38            | 0.38 | 0.3          | -                    | -                    | -                    | -             | -                    | 400 <sup>3)</sup>    |
|                     | GMA05 | 0.5             | 0.5  | 0.35         | -                    | -                    | -                    | -             | -                    | 400 <sup>3)</sup>    |
|                     | GMA08 | 0.8             | 0.8  | 0.5          | -                    | -                    | -                    | -             | -                    | 400 <sup>3)</sup>    |
|                     | GMD03 | 0.6             | 0.3  | 0.3          | 15,000               | -                    | 50,000               | -             | -                    | 1,000                |
|                     | GMD15 | 1.0             | 0.5  | 0.5          | 10,000               | -                    | 50,000               | -             | -                    | 1,000                |
| Array               | GNM0M | 0.9             | 0.6  | 0.45         | 10,000               | -                    | 50,000               | -             | -                    | 1,000                |
|                     | GNM1M | 1.37            | 1.0  | 0.5/0.6/0.8  | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     | GNM21 | 2.0             | 1.25 | 0.5/0.6/0.85 | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
|                     | GNM31 | 3.2             | 1.6  | 0.8/0.85     | 4,000                | -                    | 10,000               | -             | -                    | 1,000                |
| Low ESL             | LLL15 | 0.5             | 1.0  | 0.3          | 10,000 <sup>4)</sup> | -                    | 50,000 <sup>4)</sup> | -             | -                    | 1,000                |
|                     | LLL18 | 0.8             | 1.6  | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 0.5/0.6      | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLL21 | 1.25            | 2.0  | 0.85         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 0.5/0.7      | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLL31 | 1.6             | 3.2  | 1.15         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLA18 | 1.6             | 0.8  | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLA21 | 2.0             | 1.25 | 0.85         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLA31 | 3.2             | 1.6  | 0.85         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     |       |                 |      | 1.15         | -                    | 3,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLM21 | 2.0             | 1.25 | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |
|                     | LLM31 | 3.2             | 1.6  | 0.5          | -                    | 4,000                | -                    | 10,000        | -                    | 1,000                |

1) 8mm width 2mm pitch Paper Taping. 4mm width 1mm pitch Embossed Taping.

2) There are parts number without bulk case.

3) Tray

4) LLL15: ø180mm Reel Paper Taping Packaging Code: E, ø330mm Reel Paper Taping Packaging Code: F

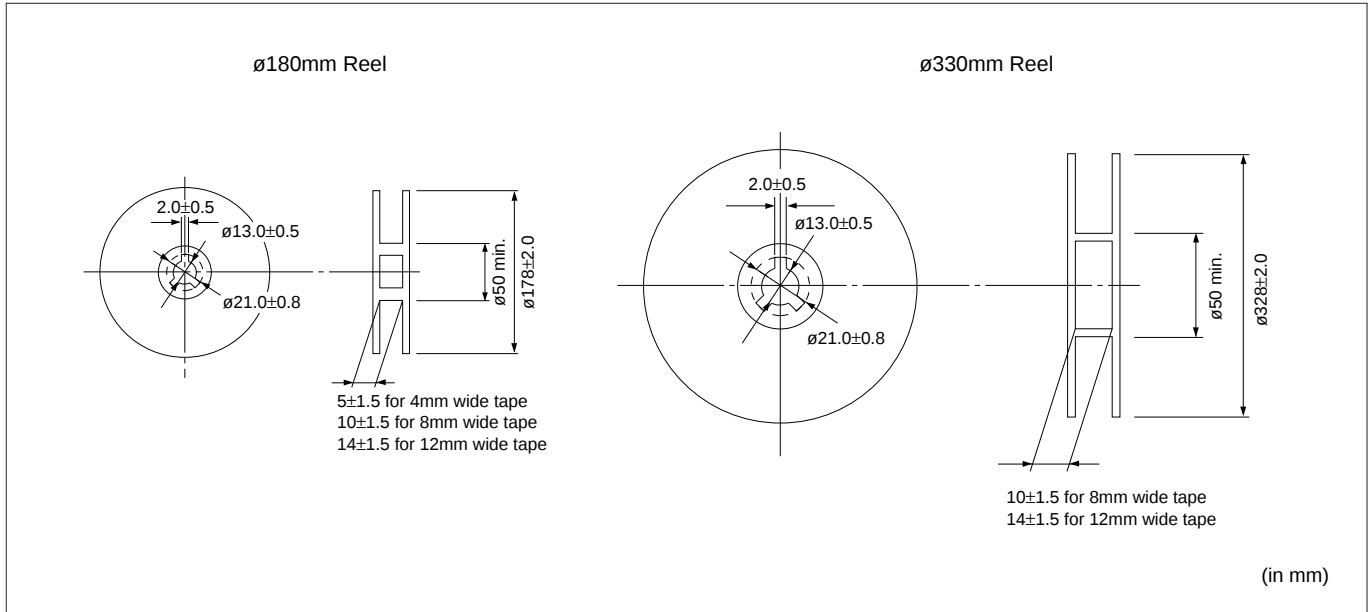
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## Package

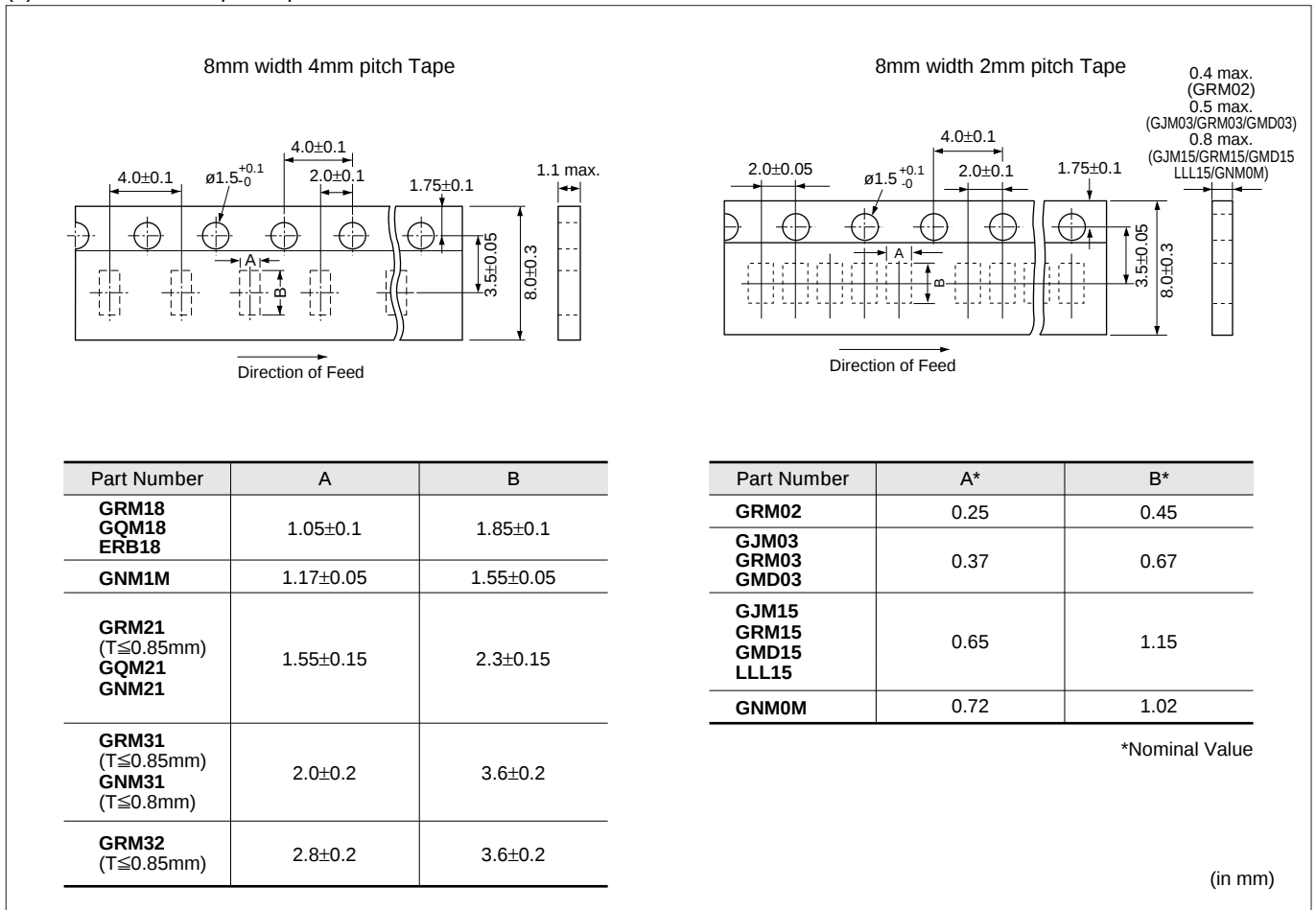
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### ■ Tape Carrier Packaging

#### (1) Dimensions of Reel



#### (2) Dimensions of Paper Tape



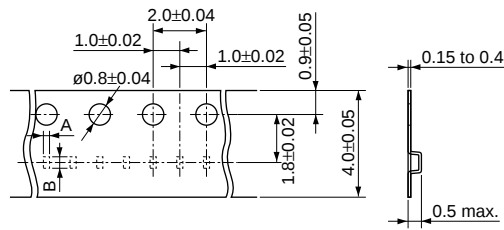
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## Package

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### (3) Dimensions of Embossed Tape

4mm width 1mm pitch Tape

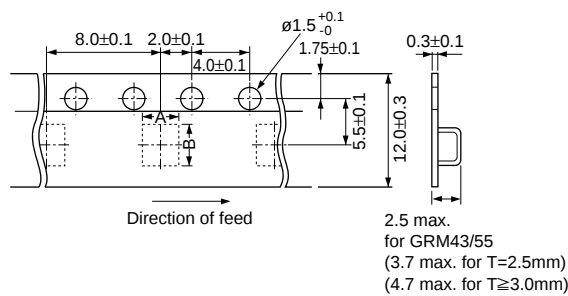


| Part Number | A*   | B*   |
|-------------|------|------|
| GRM02       | 0.23 | 0.43 |

\*Nominal Value

\*GRM03 is also available by 4mm width 1mm pitch Tape.

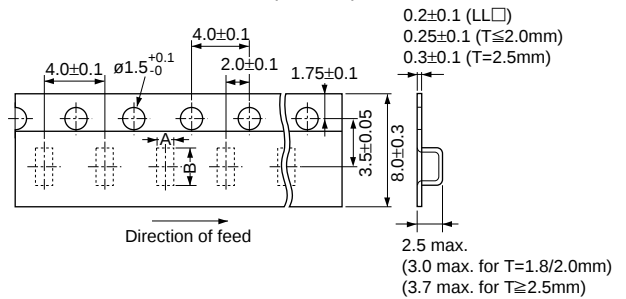
12mm width 8mm pitch Tape



| Part Number | A*  | B*  |
|-------------|-----|-----|
| GRM43       | 3.6 | 4.9 |
| GRM55       | 5.2 | 6.1 |

\*Nominal Value

8mm width 4mm pitch Tape



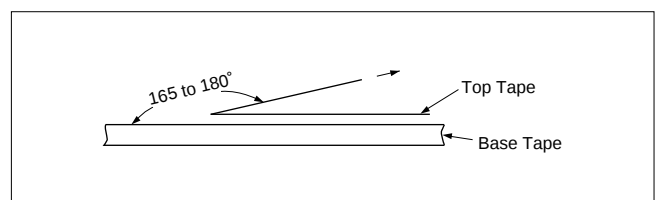
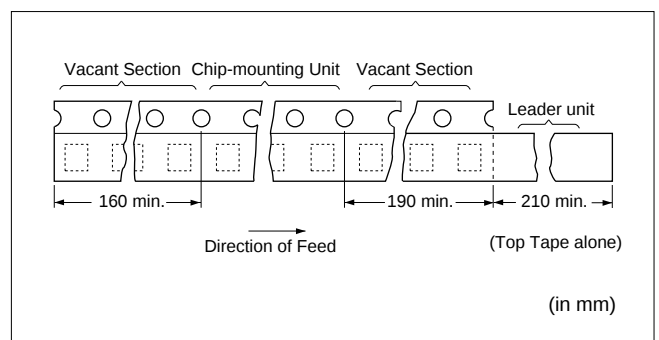
| Part Number                                                  | A        | B        |
|--------------------------------------------------------------|----------|----------|
| LLL18, LLA18                                                 | 1.05±0.1 | 1.85±0.1 |
| GRM21 (T≥1.0mm)<br>LLL21<br>LLA21, LLM21                     | 1.45±0.2 | 2.25±0.2 |
| ERB21                                                        | 1.55±0.2 | 2.3±0.2  |
| GRM31 (T≥1.15mm)<br>LLL31<br>LLA31, LLM31<br>GNM31 (T≥1.0mm) | 1.9±0.2  | 3.5±0.2  |
| GRM32, ERB32 (T≥1.0mm)                                       | 2.8±0.2  | 3.5±0.2  |

(in mm)

### (4) Taping Method

- Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
- Part of the leader and part of the empty tape should be attached to the end of the tape as follows.
- The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
- The top tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.
- Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.
- Peeling off force: 0.1 to 0.6N\* in the direction shown below.

\*GRM02  
GRM03  
GJM03  
GMD03  
: 0.05 to 0.5N

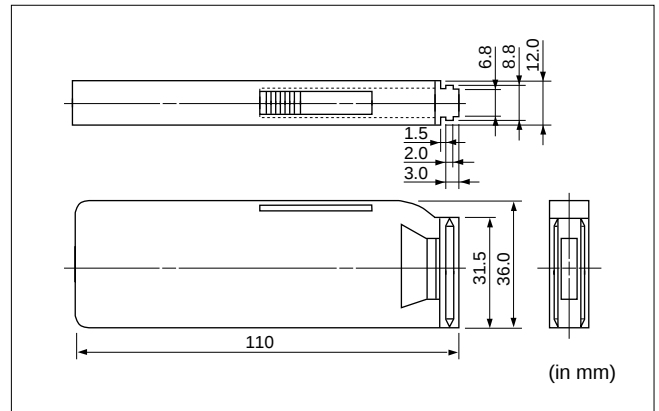


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## ■ Dimensions of Bulk Case Packaging

The bulk case uses antistatic materials. Please contact Murata for details.



## ⚠Caution

### ■ Storage and Operation condition

1. The performance of chip monolithic ceramic capacitors may be affected by the storage conditions.
  - 1-1. Store capacitors in the following conditions:  
Temperature of +5°C to +40°C and a Relative Humidity of 20% to 70%.
    - (1) Sunlight, dust, rapid temperature changes, corrosive gas atmosphere or high temperature and humidity conditions during storage may affect the solderability and the packaging performance. Please use product within six months of receipt.
    - (2) Please confirm solderability before using after six months. Store the capacitors without opening the original bag. Even if the storage period is short, do not exceed the specified atmospheric conditions.
  - 1-2. Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor solderability. Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.).
  - 1-3. Due to moisture condensation caused by rapid humidity changes, or the photochemical change caused by direct sunlight on the terminal electrodes and/or the resin/epoxy coatings, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or in high humidity conditions.



## Rating

### 1. Temperature Dependent Characteristics

1. The electrical characteristics of the capacitor can change with temperature.

1-1. For capacitors having larger temperature dependency, the capacitance may change with temperature changes.

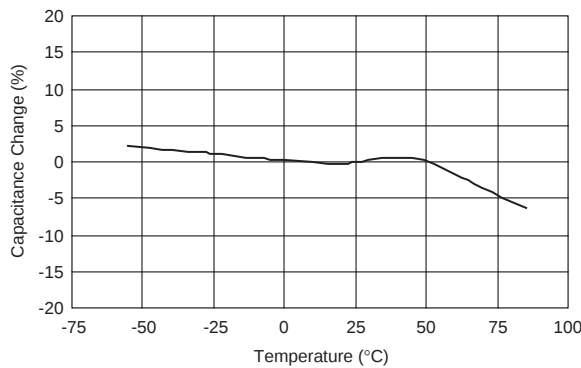
The following actions are recommended in order to insure suitable capacitance values.

(1) Select a suitable capacitance for the operating temperature range.

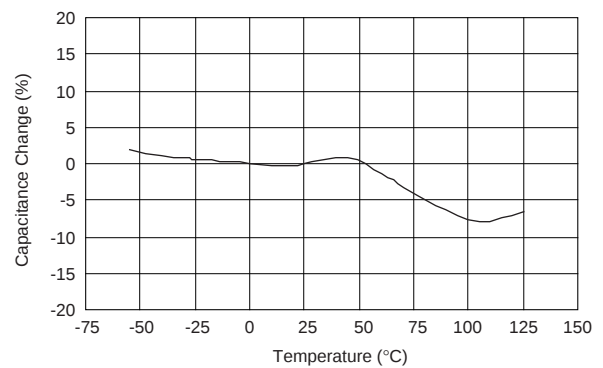
(2) The capacitance may change within the rated temperature.

When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.

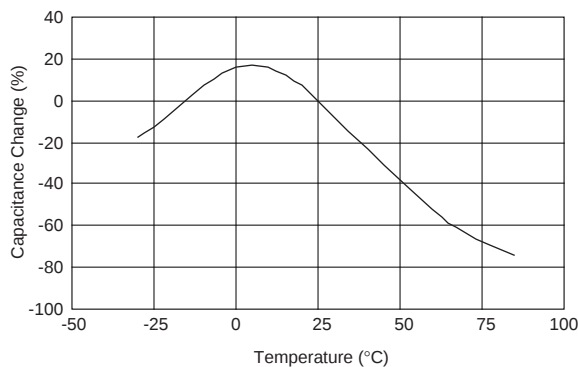
Typical Temperature Characteristics Char. R6(X5R)



Typical Temperature Characteristics Char. R7(X7R)



Typical Temperature Characteristics Char. F5(Y5V)



### 2. Measurement of Capacitance

1. Measure capacitance with the voltage and the frequency specified in the product specifications.

1-1. The output voltage of the measuring equipment may decrease when capacitance is high occasionally. Please confirm whether a prescribed measured voltage is impressed to the capacitor.

1-2. The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied. Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.

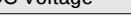
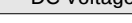
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1. Do not apply a voltage to the capacitor that exceeds the rated voltage as called-out in the specifications.

(1) When AC voltage is superimposed on DC voltage, the zero-to-peak voltage shall not exceed the rated DC voltage.

(2) Abnormal voltages (surge voltage, static electricity, pulse voltage, etc.) shall not exceed the rated DC voltage.

| DC Voltage                                                                        | DC Voltage+AC                                                                     | AC Voltage                                                                        | Pulse Voltage                                                                       |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |

## 1-2. Influence of overvoltage

#### 4. Applied Voltage and Self-heating Temperature

1. When the capacitor is used in a high-frequency voltage, pulse voltage, application, be sure to take into account self-heating may be caused by resistant factors of the capacitor.

1-1. The load should be contained to the level such that when measuring at atmospheric temperature of 25°C, the product's self-heating remains below 20°C and surface temperature of the capacitor in the actual circuit remains within the maximum operating temperature.

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## 5. DC Voltage and AC Voltage Characteristic

1. The capacitance value of a high dielectric constant type capacitor changes depending on the DC voltage applied. Please consider the DC voltage characteristics when a capacitor is selected for use in a DC circuit.

1-1. The capacitance of ceramic capacitors may change sharply depending on the applied voltage. (See figure)

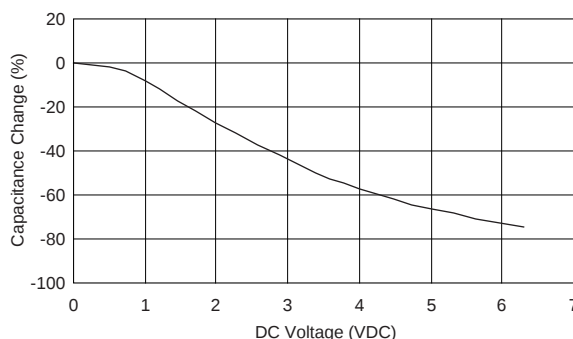
Please confirm the following in order to secure the capacitance.

- (1) Whether the capacitance change caused by the applied voltage is within the range allowed or not.
- (2) In the DC voltage characteristics, the rate of capacitance change becomes larger as voltage increases. Even if the applied voltage is below the rated voltage. When a high dielectric constant type capacitor is in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.

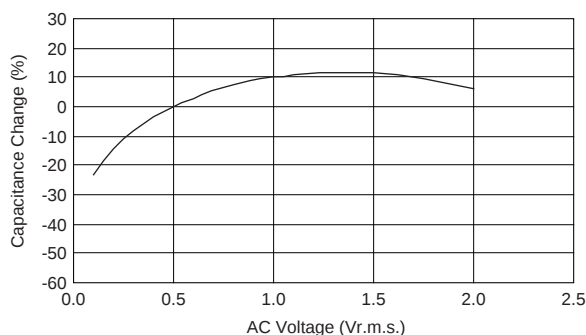
2. The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied.

Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.

[DC Voltage Characteristics]



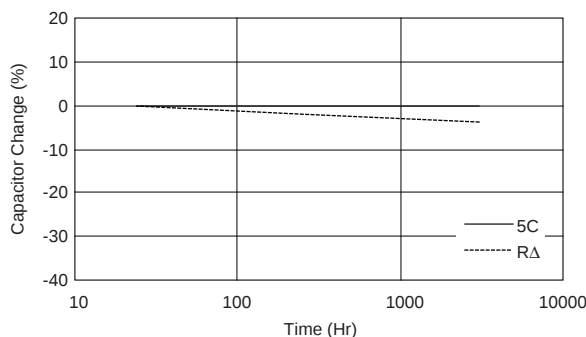
[AC Voltage Characteristics]



## 6. Capacitance Aging

1. The high dielectric constant type capacitors have the characteristic in which the capacitance value decreases with passage of time.

When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.



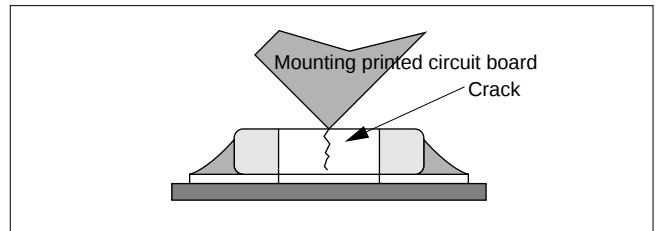
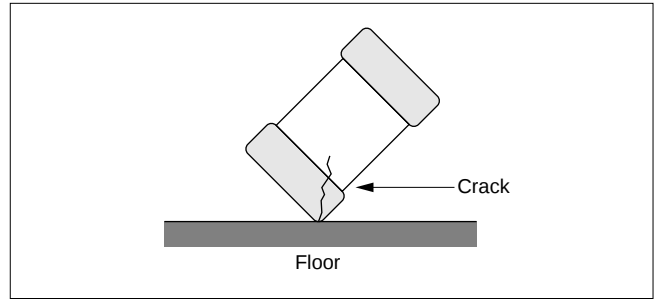
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## ⚠Caution

☐ Continued from the preceding page.

### 7. Vibration and Shock

1. The capacitors mechanical stress (vibration and shock) shall be specified for the use environment.  
 Please confirm the kind of vibration and/or shock, its condition, and any generation of resonance.  
 Please mount the capacitor so as not to generate resonance, and do not allow any impact on the terminals.
2. Mechanical shock due to falling may cause damage or a crack in the dielectric material of the capacitor.  
 Do not use a fallen capacitor because the quality and reliability may be deteriorated.
3. When printed circuit boards are piled up or handled, the corners of another printed circuit board should not be allowed to hit the capacitor in order to avoid a crack or other damage to the capacitor.

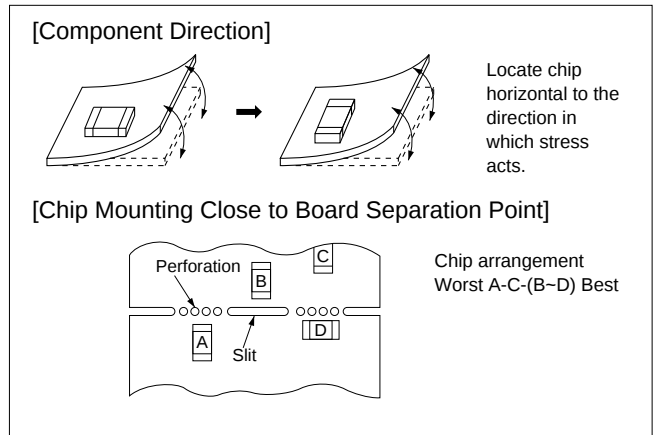


## ⚠Caution

### ■ Soldering and Mounting

#### 1. Mounting Position

1. Confirm the best mounting position and direction that minimizes the stress imposed on the capacitor during flexing or bending the printed circuit board.
- 1-1. Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.



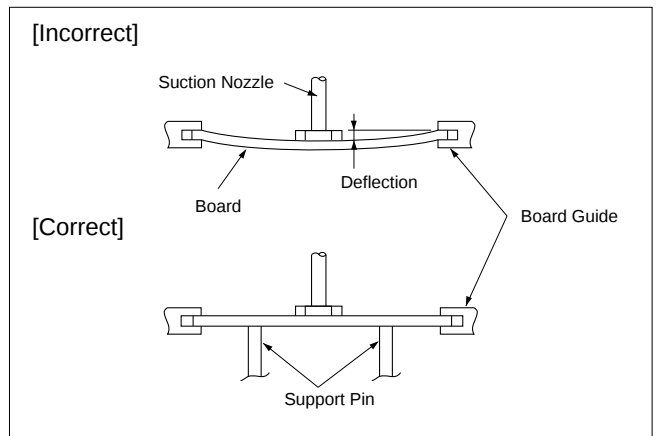
#### 2. Information before Mounting

1. Do not re-use capacitors that were removed from the equipment.
2. Confirm capacitance characteristics under actual applied voltage.
3. Confirm the mechanical stress under actual process and equipment use.
4. Confirm the rated capacitance, rated voltage and other electrical characteristics before assembly.

5. Prior to use, confirm the Solderability for the capacitors that were in long-term storage.
6. Prior to measuring capacitance, carry out a heat treatment for capacitors that were in long-term storage.
7. The use of Sn-Zn based solder will deteriorate the reliability of the MLCC.  
Please contact our sales representative or product engineers on the use of Sn-Zn based solder in advance.

#### 3. Maintenance of the Mounting (pick and place) Machine

1. Make sure that the following excessive forces are not applied to the capacitors.
  - 1-1. In mounting the capacitors on the printed circuit board, any bending force against them shall be kept to a minimum to prevent them from any bending damage or cracking. Please take into account the following precautions and recommendations for use in your process.
    - (1) Adjust the lowest position of the pickup nozzle so as not to bend the printed circuit board.
    - (2) Adjust the nozzle pressure within a static load of 1N to 3N during mounting.
2. Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes greater force upon the chip during mounting, causing cracked chips. Also the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically.



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## 4-1. Reflow Soldering

1. When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board. Preheating conditions are shown in table 1. It is required to keep the temperature differential between the solder and the components surface ( $\Delta T$ ) as small as possible.
2. Solderability of Tin plating termination chips might be deteriorated when a low temperature soldering profile where the peak solder temperature is below the melting point of Tin is used. Please confirm the Solderability of Tin plated termination chips before use.
3. When components are immersed in solvent after mounting, be sure to maintain the temperature difference ( $\Delta T$ ) between the component and the solvent within the range shown in the table 1.

Table 1

| Part Number          | Temperature Differential            |
|----------------------|-------------------------------------|
| GRM02/03/15/18/21/31 | $\Delta T \leq 190^{\circ}\text{C}$ |
| GJM03/15             |                                     |
| LLL15/18/21/31       |                                     |
| ERB18/21             |                                     |
| GQM18/21             |                                     |
| GRM32/43/55          | $\Delta T \leq 130^{\circ}\text{C}$ |
| LLA18/21/31          |                                     |
| LLM21/31             |                                     |
| GNM                  |                                     |
| ERB32                |                                     |

### Recommended Conditions

|                  | Pb-Sn Solder    |              | Lead Free Solder      |
|------------------|-----------------|--------------|-----------------------|
|                  | Infrared Reflow | Vapor Reflow |                       |
| Peak Temperature | 230 to 250°C    | 230 to 240°C | 240 to 260°C          |
| Atmosphere       | Air             | Air          | Air or N <sub>2</sub> |

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

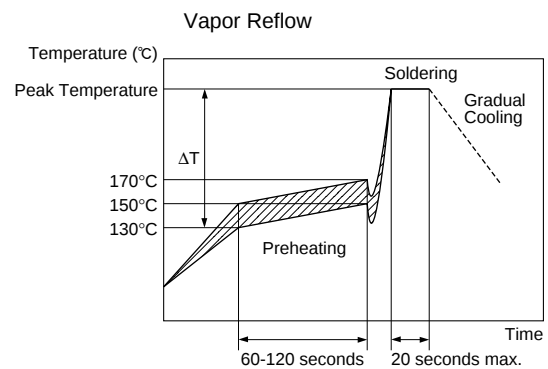
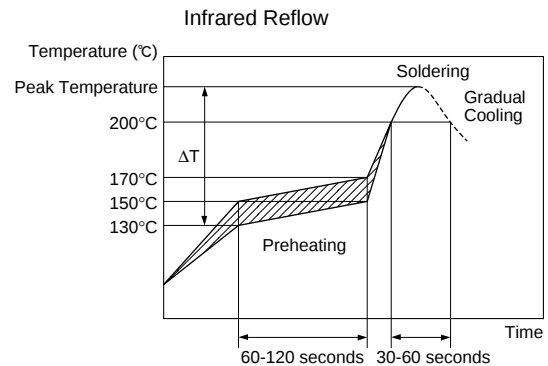
#### 4. Optimum Solder Amount for Reflow Soldering

- 4-1. Overly thick application of solder paste results in a excessive solder fillet height.  
This makes the chip more susceptible to mechanical and thermal stress on the board and may cause the chips to crack.
- 4-2. Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
- 4-3. Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm\* min.

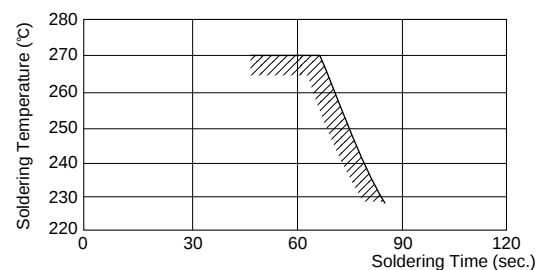
## Inverting the PCB

Make sure not to impose any abnormal mechanical shocks to the PCB.

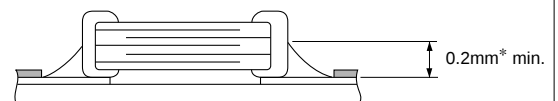
[Standard Conditions for Reflow Soldering]



[Allowable Reflow Soldering Temperature and Time]



In case of repeated soldering, the accumulated soldering time must be within the range shown above.



\* GRM02/03: 1/3 of Chip Thickness min.

in section



## ⚠Caution

☐ Continued from the preceding page.

### 4-3. Correction with a Soldering Iron

- When sudden heat is applied to the components when using a soldering iron, the mechanical strength of the components will decrease because the extreme temperature change can cause deformations inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board. Preheating conditions, (The "Temperature of the Soldering Iron Tip", "Preheating Temperature", "Temperature Differential" between the iron tip and the components and the PCB), should be within the conditions of table 3. It is required to keep the temperature differential between the soldering iron and the component surfaces ( $\Delta T$ ) as small as possible.
- After soldering, do not allow the component/PCB to rapidly cool down.
- The operating time for the re-working should be as short as possible. When re-working time is too long, it may cause solder leaching, and that will cause a reduction in the adhesive strength of the terminations.
- Optimum Solder amount when re-working with a Soldering Iron
  - In case of sizes smaller than 0603, (GRM03/15/18, GJM03/15, GQM18, ERB18), the top of the solder fillet should be lower than 2/3's of the thickness of the component or 0.5mm whichever is smaller. In case of 0805 and larger sizes, (GRM21/31/32/43/55, GQM21, ERB21/32), the top of the solder fillet should be lower than 2/3's of the thickness of the component. If the solder amount is excessive, the risk of cracking is higher during board bending or under any other stressful condition.
  - A soldering iron with a tip of  $\phi 3\text{mm}$  or smaller should be used. It is also necessary to keep the soldering iron from touching the components during the re-work.
  - Solder wire with  $\phi 0.5\text{mm}$  or smaller is required for soldering.

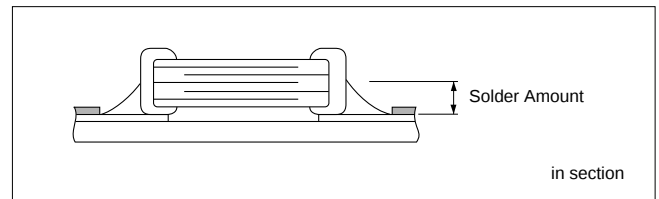
Table 3

| Part Number                                           | Temperature of Soldering Iron Tip | Preheating Temperature | Temperature Differential ( $\Delta T$ ) | Atmosphere |
|-------------------------------------------------------|-----------------------------------|------------------------|-----------------------------------------|------------|
| GRM03/15/18/21/31<br>GJM03/15<br>GQM18/21<br>ERB18/21 | 350°C max.                        | 150°C min.             | $\Delta T \leq 190^\circ\text{C}$       | Air        |
| GRM32/43/55<br>ERB32                                  | 280°C max.                        | 150°C min.             | $\Delta T \leq 130^\circ\text{C}$       | Air        |

\*Applicable for both Pb-Sn and Lead Free Solder.

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu



### 4-4. Leaded Component Insertion

- If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.  
Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping.

### 5. Washing

Excessive ultrasonic oscillation during cleaning can cause the PCBs to resonate, resulting in cracked chips or broken solder joints. Take note not to vibrate PCBs.

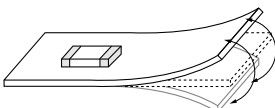
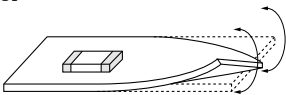
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1. Confirm position of the support pin or specific jig, when inspecting the electrical performance of a capacitor after mounting on the printed circuit board.

- The thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints. Provide support pins on the back side of the PCB to prevent warping or flexing.

- [Not Recommended]
- 
- This diagram shows a horizontal beam with a central support pin. A rectangular load is applied to the top of the beam, centered over the support. The beam is shown with a significant downward deflection in the middle. Labels include "Peeling" with an arrow pointing to the top surface of the beam under the load, and "Test-pin" with an arrow pointing to the central support pin.
- [Recommended]
- 
- This diagram shows a horizontal beam with a central support pin. A rectangular load is applied to the top of the beam, centered over the support. The beam is supported at both ends by "Support Pin"s. The beam is shown with a slight downward deflection in the middle. Labels include "Support Pin" with an arrow pointing to one of the end supports, and "Test-pin" with an arrow pointing to the central support pin.

1. After mounting a capacitor on a printed circuit board, do not apply any stress to the capacitor that is caused by bending or twisting the board.

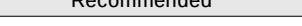
- [Bending]
- 
- The diagram shows a rectangular plate with a small rectangular block representing a point load applied to its center. The plate is shown in a bent state, with dashed lines indicating its original flat position. A curved arrow on the right side indicates the direction of the bending moment.
- [Twisting]
- 
- The diagram shows a rectangular plate with a small rectangular block representing a point load applied to its center. The plate is shown in a twisted state, with dashed lines indicating its original flat position. A curved arrow on the right side indicates the direction of the twisting moment.

- 2-1. Printed circuit board cropping shall be carried out by using a jig or an apparatus to prevent the mechanical stress which can occur to the board.

- Recommended example: the board should be pushed as close to the near the cropping jig as possible and from the back side of board in order to minimize the compressive stress applied to capacitor.

[Outline of Jig]

The diagram shows a 3D perspective of a 'Boad Cropping Jig' (sic). It consists of a rectangular base with a V-shaped groove cut into its top surface. A 'Printed Circuit Board' is shown being cut by a tool that fits into the V-groove. Labels with leader lines identify the 'Printed Circuit Board', the 'V-groove', and the 'Boad Cropping Jig'.

| Recommended                                                                         | Not recommended                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |

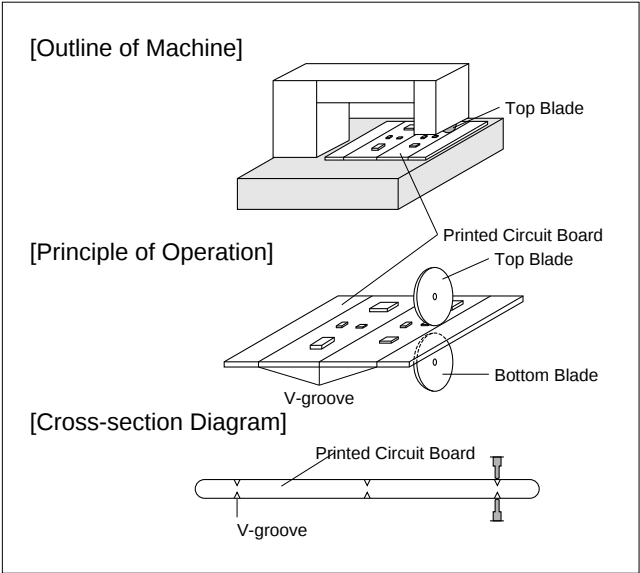
***muRata***

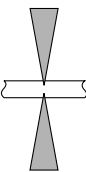
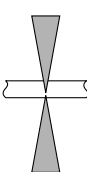
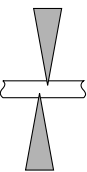
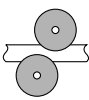
⚠Caution

 Continued from the preceding page.

(2) Example of a suitable machine

An outline of a printed circuit board cropping machine is shown as follows. Along the lines with the V-grooves on printed circuit board, the top and bottom blades are aligned to one another when cropping the board.  
The misalignment of the position between top and bottom blades may cause the capacitor to crack.



| Recommended                                                                                                                     | Not Recommended                                                                                                                 |                                                                                                                                  |                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                 | Top-bottom Misalignment                                                                                                         | Left-right Misalignment                                                                                                          | Front-rear Misalignment                                                                                                           |
|  <div>Top Blade</div> <div>Bottom Blade</div> |  <div>Top Blade</div> <div>Bottom Blade</div> |  <div>Top Blade</div> <div>Bottom Blade</div> |  <div>Top Blade</div> <div>Bottom Blade</div> |



## ■ Others

### 1. Under Operation of Equipment

- 1-1. Do not touch a capacitor directly with bare hands during operation in order to avoid the danger of a electric shock.
- 1-2. Do not allow the terminals of a capacitor to come in contact with any conductive objects (short-circuit). Do not expose a capacitor to a conductive liquid, inducing any acid or alkali solutions.
- 1-3. Confirm the environment in which the equipment will operation is under the specified conditions. Do not use the equipment under the following environment.
  - (1) Being spattered with water or oil.
  - (2) Being exposed to direct sunlight.
  - (3) Being exposed to Ozone, ultraviolet rays or radiation.
  - (4) Being exposed to toxic gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.)
  - (5) Any vibrations or mechanical shocks exceeding the specified limits.
  - (6) Moisture condensing environments.
- 1-4. Use damp proof countermeasures if using under any conditions that can cause condensation.

### 2. Others

- 2-1. In an Emergency
  - (1) If the equipment should generate smoke, fire or smell, immediately turn off or unplug the equipment.

If the equipment is not turned off or unplugged, the hazards may be worsened by supplying continuous power.

- (2) In this type of situation, do not allow face and hands to come in contact with the capacitor or burns may be caused by the capacitors high temperature.

### 2-2. Disposal of Waste

When capacitors are disposed, they must be burned or buried by the industrial waste vender with the appropriate licenses.

### 2-3. Circuit Design

GRM, GCM, GMA/D, LLL/A/M, ERB, GQM, GJM, GNM Series capacitors in this catalog are not safety certified products.

### 2-4. Remarks

Failure to follow the cautions may result, worst case, in a short circuit and smoking when the product is used.

The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions.

Select optimum conditions for operation as they determine the reliability of the product after assembly.

The data herein are given in typical values, not guaranteed ratings.

## Notice

### ■ Rating

#### 1. Operating Temperature

1. The operating temperature limit depends on the capacitor.

- 1-1. Do not apply temperatures exceeding the upper operating temperature.

It is necessary to select a capacitor with a suitable rated temperature which will cover the operating temperature range.

Also it is necessary to consider the temperature distribution in equipment and the seasonal temperature variable factor.

- 1-2. Consider the self-heating of the capacitor

The surface temperature of the capacitor shall be the upper operating temperature or less when including the self-heating factors.

#### 2. Atmosphere Surroundings (gaseous and liquid)

1. Restriction on the operating environment of capacitors.

- 1-1. The capacitor, when used in the above, unsuitable, operating environments may deteriorate due to the corrosion of the terminations and the penetration of moisture into the capacitor.

- 1-2. The same phenomenon as the above may occur when the electrodes or terminals of the capacitor are subject to moisture condensation.

- 1-3. The deterioration of characteristics and insulation resistance due to the oxidization or corrosion of terminal electrodes may result in breakdown when the capacitor is exposed to corrosive or volatile gases or solvents for long periods of time.

#### 3. Piezo-electric Phenomenon

1. When using high dielectric constant type capacitors in AC or pulse circuits, the capacitor itself vibrates at specific frequencies and noise may be generated. Moreover, when the mechanical vibration or shock is added to capacitor, noise may occur.

- 1-1. Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate. They are also more sensitive to mechanical and thermal stresses than leaded components. Excess solder fillet height can multiply these stresses and cause chip cracking. When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.
- 1-2. It is possible for the chip to crack by the expansion and shrinkage of a metal board. Please contact us if you want to use our ceramic capacitors on a metal board such as Aluminum.

## Pattern Forms

|                                                   | Prohibited                                                     | Correct              |
|---------------------------------------------------|----------------------------------------------------------------|----------------------|
| Placing Close to Chassis                          | <p>Chassis</p> <p>Solder (ground)</p> <p>Electrode Pattern</p> | <p>Solder Resist</p> |
| Placing of Chip Components and Leaded Components  | <p>Lead Wire</p>                                               | <p>Solder Resist</p> |
| Placing of Leaded Components after Chip Component | <p>Soldering Iron</p> <p>Lead Wire</p>                         | <p>Solder Resist</p> |
| Lateral Mounting                                  |                                                                | <p>Solder Resist</p> |

Continued on the following page. 

## Notice

Continued from the preceding page.

### 2. Land Dimensions

2-1. Chip capacitor can be cracked due to the stress of PCB bending / etc if the land area is larger than needed and has an excess amount of solder. Please refer to the land dimensions in table 1 for flow soldering, table 2 for reflow soldering, table 3 for GNM & LLA, and table 4 for LLM. Please confirm the suitable land dimension by evaluating of the actual SET / PCB.

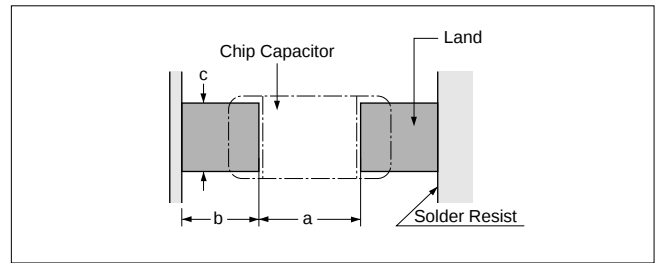


Table 1 Flow Soldering Method

| Part Number    | Dimensions<br>Chip (L×W) | a          | b          | c          |
|----------------|--------------------------|------------|------------|------------|
| GRM18<br>GQM18 | 1.6×0.8                  | 0.6 to 1.0 | 0.8 to 0.9 | 0.6 to 0.8 |
| GRM21<br>GQM21 | 2.0×1.25                 | 1.0 to 1.2 | 0.9 to 1.0 | 0.8 to 1.1 |
| GRM31          | 3.2×1.6                  | 2.2 to 2.6 | 1.0 to 1.1 | 1.0 to 1.4 |
| LLL21          | 1.25×2.0                 | 0.4 to 0.7 | 0.5 to 0.7 | 1.4 to 1.8 |
| LLL31          | 1.6×3.2                  | 0.6 to 1.0 | 0.8 to 0.9 | 2.6 to 2.8 |
| ERB11          | 1.25×1.0                 | 0.4 to 0.6 | 0.6 to 0.8 | 0.8 to 1.0 |
| ERB21          | 2.0×1.25                 | 1.0 to 1.2 | 0.9 to 1.0 | 0.8 to 1.0 |
| ERF1D          | 1.4×1.4                  | 0.5 to 0.8 | 0.8 to 0.9 | 1.0 to 1.2 |

(in mm)

Table 2 Reflow Soldering Method

| Part Number    | Dimensions<br>Chip (L×W) | a           | b            | c           |
|----------------|--------------------------|-------------|--------------|-------------|
| GRM02          | 0.4×0.2                  | 0.16 to 0.2 | 0.12 to 0.18 | 0.2 to 0.23 |
| GRM03<br>GJM03 | 0.6×0.3                  | 0.2 to 0.3  | 0.2 to 0.35  | 0.2 to 0.4  |
| GRM15<br>GJM15 | 1.0×0.5                  | 0.3 to 0.5  | 0.35 to 0.45 | 0.4 to 0.6  |
| GRM18<br>GQM18 | 1.6×0.8                  | 0.6 to 0.8  | 0.6 to 0.7   | 0.6 to 0.8  |
| GRM21<br>GQM21 | 2.0×1.25                 | 1.0 to 1.2  | 0.6 to 0.7   | 0.8 to 1.1  |
| GRM31          | 3.2×1.6                  | 2.2 to 2.4  | 0.8 to 0.9   | 1.0 to 1.4  |
| GRM32          | 3.2×2.5                  | 2.0 to 2.4  | 1.0 to 1.2   | 1.8 to 2.3  |
| GRM43          | 4.5×3.2                  | 3.0 to 3.5  | 1.2 to 1.4   | 2.3 to 3.0  |
| GRM55          | 5.7×5.0                  | 4.0 to 4.6  | 1.4 to 1.6   | 3.5 to 4.8  |
| LLL15          | 0.5×1.0                  | 0.15 to 0.2 | 0.2 to 0.25  | 0.7 to 1.0  |
| LLL18          | 0.8×1.6                  | 0.2 to 0.3  | 0.3 to 0.4   | 1.4 to 1.6  |
| LLL21          | 1.25×2.0                 | 0.4 to 0.6  | 0.4 to 0.5   | 1.4 to 1.8  |
| LLL31          | 1.6×3.2                  | 0.6 to 0.8  | 0.6 to 0.7   | 2.6 to 2.8  |
| ERB11          | 1.25×1.0                 | 0.4 to 0.6  | 0.6 to 0.8   | 0.8 to 1.0  |
| ERB21          | 2.0×1.25                 | 1.0 to 1.2  | 0.6 to 0.8   | 0.8 to 1.0  |
| ERB32          | 3.2×2.5                  | 2.2 to 2.5  | 0.8 to 1.0   | 1.9 to 2.3  |
| ERF1D          | 1.4×1.4                  | 0.4 to 0.8  | 0.6 to 0.8   | 1.0 to 1.2  |
| ERF22          | 2.8×2.8                  | 1.8 to 2.1  | 0.7 to 0.9   | 2.2 to 2.6  |

(in mm)

Continued on the following page. ↗

## Notice

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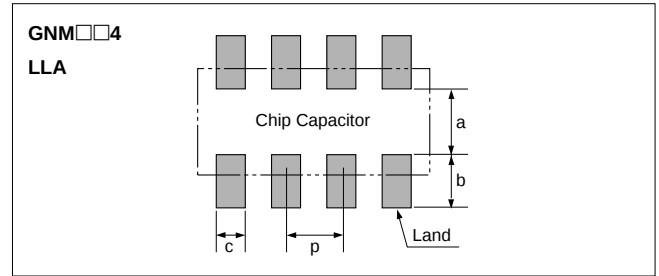
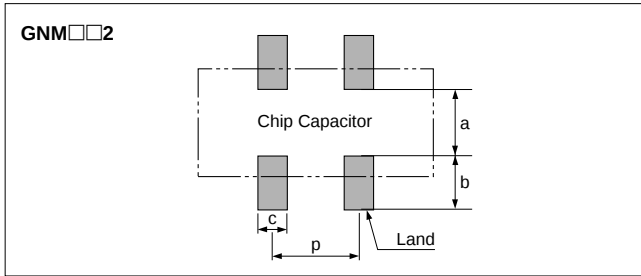


Table 3 GNM, LLA Series for Reflow Soldering Land Dimensions

| Part Number   | Dimensions (mm) |      |               |               |              |      |
|---------------|-----------------|------|---------------|---------------|--------------|------|
|               | L               | W    | a             | b             | c            | p    |
| <b>GNM0M2</b> | 0.9             | 0.6  | 0.12 to 0.20* | 0.35 to 0.40* | 0.3          | 0.45 |
| <b>GNM1M2</b> | 1.37            | 1.0  | 0.4 to 0.5    | 0.35 to 0.45  | 0.3 to 0.35  | 0.64 |
| <b>GNM212</b> | 2.0             | 1.25 | 0.6 to 0.7    | 0.5 to 0.7    | 0.4 to 0.5   | 1.0  |
| <b>GNM214</b> | 2.0             | 1.25 | 0.6 to 0.7    | 0.5 to 0.7    | 0.25 to 0.35 | 0.5  |
| <b>GNM314</b> | 3.2             | 1.6  | 0.8 to 1.0    | 0.7 to 0.9    | 0.3 to 0.4   | 0.8  |
| <b>LLA18</b>  | 1.6             | 0.8  | 0.3 to 0.4    | 0.25 to 0.35  | 0.15 to 0.25 | 0.4  |
| <b>LLA21</b>  | 2.0             | 1.25 | 0.5 to 0.7    | 0.35 to 0.6   | 0.2 to 0.3   | 0.5  |
| <b>LLA31</b>  | 3.2             | 1.6  | 0.7 to 0.9    | 0.4 to 0.7    | 0.3 to 0.4   | 0.8  |

$$* 0.82 \leq a+2b \leq 1.00$$

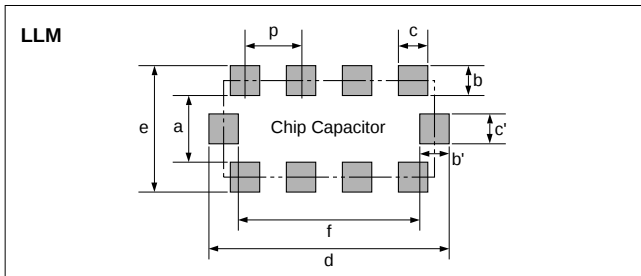


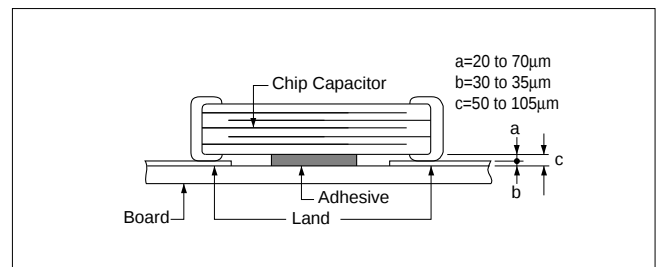
Table 4 LLM Series for Reflow Soldering Land Dimensions

| Part Number  | Dimensions (mm) |              |       |            |            |            |     |
|--------------|-----------------|--------------|-------|------------|------------|------------|-----|
|              | a               | b, b'        | c, c' | d          | e          | f          | p   |
| <b>LLM21</b> | 0.6 to 0.8      | (0.3 to 0.5) | 0.3   | 2.0 to 2.6 | 1.3 to 1.8 | 1.4 to 1.6 | 0.5 |
| <b>LLM31</b> | 1.0             | (0.3 to 0.5) | 0.4   | 3.2 to 3.6 | 1.6 to 2.0 | 2.6        | 0.8 |

$$b=(c-e)/2, b'=(d-f)/2$$

## 2. Adhesive Application

- Thin or insufficient adhesive can cause the chips to loosen or become disconnected during flow soldering. The amount of adhesive must be more than dimension c, shown in the drawing at right, to obtain the correct bonding strength. The chip's electrode thickness and land thickness must also be taken into consideration.
- Low viscosity adhesive can cause chips to slip after mounting. The adhesive must have a viscosity of 5000Pa · s (500ps) min. (at 25°C).
- Adhesive Coverage



| Part Number                | Adhesive Coverage* |
|----------------------------|--------------------|
| <b>GRM18, GQM18</b>        | 0.05mg min.        |
| <b>GRM21, LLL21, GQM21</b> | 0.1mg min.         |
| <b>GRM31, LLL31</b>        | 0.15mg min.        |

\*Nominal Value

Continued on the following page.

## Notice

Continued from the preceding page.

### 3. Adhesive Curing

1. Insufficient curing of the adhesive can cause chips to disconnect during flow soldering and causes deterioration in the insulation resistance between the outer electrodes due to moisture absorption.

Control curing temperature and time in order to prevent insufficient hardening.

### 4. Flux Application

1. An excessive amount of flux generates a large quantity of flux gas, which can cause a deterioration of Solderability. So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
2. Flux containing too a high percentage of halide may cause corrosion of the outer electrodes unless there is sufficient cleaning. Use flux with a halide content of 0.2% max.

3. Do not use strong acidic flux.

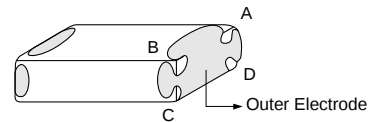
4. Do not use water-soluble flux.

(\*Water-soluble flux can be defined as non rosin type flux including wash-type flux and non-wash-type flux.)

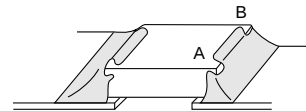
### 5. Flow Soldering

- Set temperature and time to ensure that leaching of the outer electrode does not exceed 25% of the chip end area as a single chip (full length of the edge A-B-C-D shown right) and 25% of the length A-B shown below as mounted on substrate.

[As a Single Chip]



[As Mounted on Substrate]



### 6. Washing

1. Please evaluate a capacitor by actual cleaning equipment and condition surely for confirming the quality and select the applicable solvent.
2. Unsuitable cleaning solvent may leave residual flux, other foreign substances, causing deterioration of electrical characteristics and the reliability of the capacitors.

3. Select the proper cleaning conditions.

- 3-1. Improper cleaning conditions (excessive or insufficient) may result in the deterioration of the performance of the capacitors.

Continued on the following page. ↗

## Notice

 Continued from the preceding page.

### 7. Coating

1. A crack may be caused in the capacitor due to the stress of the thermal contraction of the resin during curing process.

The stress is affected by the amount of resin and curing contraction.

Select a resin with small curing contraction.

The difference in the thermal expansion coefficient between a coating resin or a molding resin and capacitor may cause the destruction and deterioration of the capacitor such as a crack or peeling, and lead to the deterioration of insulation resistance or dielectric breakdown.

Select a resin for which the thermal expansion coefficient is as close to that of capacitor as possible.

A silicone resin can be used as an under-coating to buffer against the stress.

2. Select a resin that is less hygroscopic.  
Using hygroscopic resins under high humidity conditions may cause the deterioration of the insulation resistance of a capacitor.  
An epoxy resin can be used as a less hygroscopic resin.

### 8. Die Bonding/Wire Bonding (GMA or GMD Series)

#### 1. Die Bonding of Capacitors

- Use the following materials for the Brazing alloys:  
Au-Sn (80/20) 300 to 320 degree C in N<sub>2</sub> atmosphere
- Mounting
  - (1) Control the temperature of the substrate so it matches the temperature of the brazing alloy.
  - (2) Place the brazing alloy on the substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation within 1 minute.

#### 2. Wire Bonding

- Wire  
Gold wire: 25 micro m (0.001 inch) diameter
- Bonding
  - (1) Thermo compression, ultrasonic ball bonding.
  - (2) Required stage temperature: 150 to 200 degree C
  - (3) Required wedge or capillary weight: 0.2N to 0.5N
  - (4) Bond the capacitor and base substrate or other devices with gold wire.

## Notice

### ■ Others

#### 1. Transportation

1. The performance of a capacitor may be affected by the conditions during transportation.

- 1-1. The capacitors shall be protected against excessive temperature, humidity and mechanical force during transportation.

##### (1) Climatic condition

- low air temperature: -40°C
- change of temperature air/air: -25°C/+25°C
- low air pressure: 30 kPa
- change of air pressure: 6 kPa/min.

##### (2) Mechanical condition

Transportation shall be done in such a way that the boxes are not deformed and forces are not directly passed on to the inner packaging.

- 1-2. Do not apply excessive vibration, shock, and pressure to the capacitor.

- (1) When excessive mechanical shock or pressure is applied to a capacitor, chipping or cracking may occur in the ceramic body of the capacitor.
- (2) When a sharp edge of an air driver, a soldering iron, tweezers, a chassis, etc. impacts strongly on the surface of capacitor, the capacitor may crack and short-circuit.

- 1-3. Do not use a capacitor to which excessive shock was applied by dropping, etc.

The capacitor dropped accidentally during processing may be damaged.



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**GRM21 5C (T=0.6)**

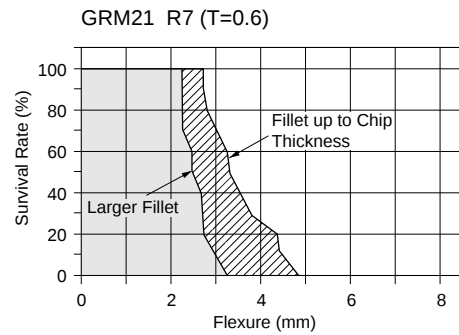
Survival Rate (%) vs. Flexure (mm) for GRM21 5C at T=0.6. The graph shows a shaded region for 'Larger Fillet' and a hatched region for 'Fillet up to Chip Thickness'.

| Flexure (mm) | Survival Rate (%) - Larger Fillet | Survival Rate (%) - Fillet up to Chip Thickness |
|--------------|-----------------------------------|-------------------------------------------------|
| 0            | 100                               | 100                                             |
| 2            | 100                               | 100                                             |
| 3            | 100                               | 100                                             |
| 4            | 100                               | 100                                             |
| 5            | 100                               | 100                                             |
| 6            | 100                               | 100                                             |
| 7            | 100                               | 100                                             |
| 8            | 100                               | 100                                             |
| 9            | 100                               | 100                                             |
| 10           | 100                               | 100                                             |
| 11           | 100                               | 100                                             |
| 12           | 100                               | 100                                             |
| 13           | 100                               | 100                                             |
| 14           | 100                               | 100                                             |
| 15           | 100                               | 100                                             |
| 16           | 100                               | 100                                             |
| 17           | 100                               | 100                                             |
| 18           | 100                               | 100                                             |
| 19           | 100                               | 100                                             |
| 20           | 100                               | 100                                             |
| 21           | 100                               | 100                                             |
| 22           | 100                               | 100                                             |
| 23           | 100                               | 100                                             |
| 24           | 100                               | 100                                             |
| 25           | 100                               | 100                                             |
| 26           | 100                               | 100                                             |
| 27           | 100                               | 100                                             |
| 28           | 100                               | 100                                             |
| 29           | 100                               | 100                                             |
| 30           | 100                               | 100                                             |
| 31           | 100                               | 100                                             |
| 32           | 100                               | 100                                             |
| 33           | 100                               | 100                                             |
| 34           | 100                               | 100                                             |
| 35           | 100                               | 100                                             |
| 36           | 100                               | 100                                             |
| 37           | 100                               | 100                                             |
| 38           | 100                               | 100                                             |
| 39           | 100                               | 100                                             |
| 40           | 100                               | 100                                             |
| 41           | 100                               | 100                                             |
| 42           | 100                               | 100                                             |
| 43           | 100                               | 100                                             |
| 44           | 100                               | 100                                             |
| 45           | 100                               | 100                                             |
| 46           | 100                               | 100                                             |
| 47           | 100                               | 100                                             |
| 48           | 100                               | 100                                             |
| 49           | 100                               | 100                                             |
| 50           | 100                               | 100                                             |
| 51           | 100                               | 100                                             |
| 52           | 100                               | 100                                             |
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| 56           | 100                               | 100                                             |
| 57           | 100                               | 100                                             |
| 58           | 100                               | 100                                             |
| 59           | 100                               | 100                                             |
| 60           | 100                               | 100                                             |
| 61           | 100                               | 100                                             |
| 62           | 100                               | 100                                             |
| 63           | 100                               | 100                                             |
| 64           | 100                               | 100                                             |
| 65           | 100                               | 100                                             |
| 66           | 100                               | 100                                             |
| 67           | 100                               | 100                                             |
| 68           | 100                               | 100                                             |
| 69           | 100                               | 100                                             |
| 70           | 100                               | 100                                             |
| 71           | 100                               | 100                                             |
| 72           | 100                               | 100                                             |
| 73           | 100                               | 100                                             |
| 74           | 100                               | 100                                             |
| 75           | 100                               | 100                                             |
| 76           | 100                               | 100                                             |
| 77           | 100                               | 100                                             |
| 78           | 100                               | 100                                             |
| 79           | 100                               | 100                                             |
| 80           | 100                               | 100                                             |
| 81           | 100                               | 100                                             |
| 82           | 100                               | 100                                             |
| 83           | 100                               | 100                                             |
| 84           | 100                               | 100                                             |
| 85           | 100                               | 100                                             |
| 86           | 100                               | 100                                             |
| 87           | 100                               | 100                                             |
| 88           | 100                               | 100                                             |
| 89           | 100                               | 100                                             |
| 90           | 100                               | 100                                             |
| 91           | 100                               | 100                                             |
| 92           | 100                               | 100                                             |
| 93           | 100                               | 100                                             |
| 94           | 100                               | 100                                             |
| 95           | 100                               | 100                                             |
| 96           | 100                               | 100                                             |
| 97           | 100                               | 100                                             |
| 98           | 100                               | 100                                             |
| 99           | 100                               | 100                                             |
| 100          | 100                               | 100                                             |

**GRM21 F5 (T=0.6)**

Survival Rate (%) vs. Flexure (mm) for GRM21 F5 at T=0.6. The graph shows a shaded region for 'Larger Fillet' and a hatched region for 'Fillet up to Chip Thickness'.

| Flexure (mm) | Survival Rate (%) - Larger Fillet | Survival Rate (%) - Fillet up to Chip Thickness |
|--------------|-----------------------------------|-------------------------------------------------|
| 0            | 100                               | 100                                             |
| 2            | 100                               | 100                                             |
| 3            | 100                               | 100                                             |
| 4            | 100                               | 100                                             |
| 5            | 100                               | 100                                             |
| 6            | 100                               | 100                                             |
| 7            | 100                               | 100                                             |
| 8            | 100                               | 100                                             |
| 9            | 100                               | 100                                             |
| 10           | 100                               | 100                                             |
| 11           | 100                               | 100                                             |
| 12           | 100                               | 100                                             |
| 13           | 100                               | 100                                             |
| 14           | 100                               |                                                 |



The graph shows the room temperature profile over time. The temperature starts at 0°C, drops to -55°C for 5 minutes, returns to 0°C for 30 minutes, drops to -55°C for 5 minutes, and returns to 0°C for 30 minutes. The temperature then rises to +125°C for 30 minutes.

| Substrate         |   | Alumina                                                                                    | Glass Epoxy<br>or Paper Phenol                                                             |
|-------------------|---|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Solder Amount     | ① |  0.5T |  T    |
|                   | ② |  0.7T |  1.3T |
|                   | ③ |  T    |  1.6T |
| Solder to be used |   | 6X4 Eutectic solder                                                                        |                                                                                            |

Figure 1 shows the dimensions of the test specimen. The specimen is a rectangle with a width of 1.5 mm and a height of 1.5 mm. The width is divided into three sections: a central section with a width of 1.2 mm and two side sections with widths of 1.5 mm each. The central section is labeled 'Land Pattern'.

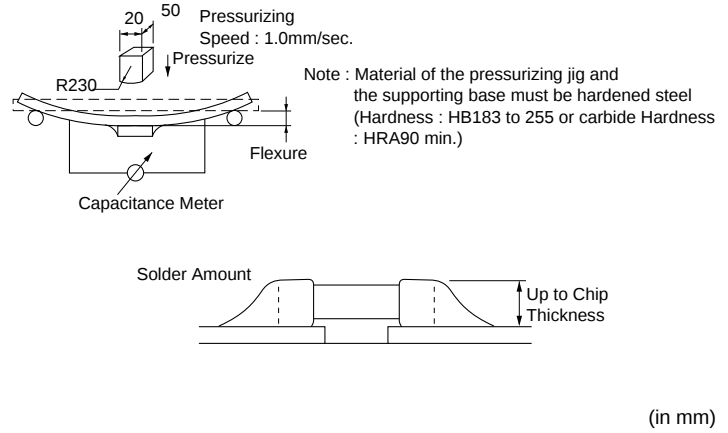
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## Continued from the preceding page.

### (1) Test Method

Figure 1 shows the dimensions of the test board. The top view indicates a total width of 100 and a central capacitor area of 4.0. The side view shows a thickness of 1.6. The legend specifies that white areas are Copper Foil (0.035mm thick) and hatched areas are Solder Resist.



### GRM21 5C/R7/F5 Characteristics T=0.6mm typical

Products should be determined to be defective if the change in capacitance has exceeded the values specified in Table 4.

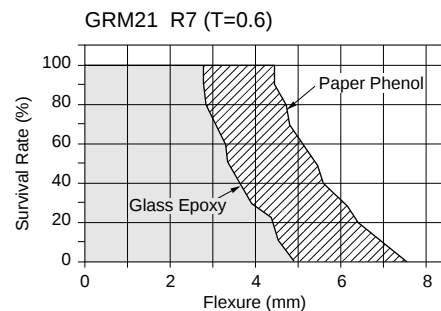
| Characteristics | Change in Capacitance                                         |
|-----------------|---------------------------------------------------------------|
| <b>5C</b>       | Within $\pm 5\%$ or $\pm 0.5\text{pF}$ , whichever is greater |
| <b>R7</b>       | Within $\pm 12.5\%$                                           |
| <b>F5</b>       | Within $\pm 20\%$                                             |

**GRM21 5C (T=0.6)**

| Flexure (mm) | Glass Epoxy Survival Rate (%) | Paper Phenol Survival Rate (%) |
|--------------|-------------------------------|--------------------------------|
| 0            | 100                           | 100                            |
| 2            | 100                           | 100                            |
| 3            | 100                           | 100                            |
| 4            | 100                           | 100                            |
| 5            | 20                            | 100                            |
| 6            | 0                             | 60                             |
| 7            | 0                             | 20                             |
| 8            | 0                             | 0                              |

**GRM21 F5 (T=0.6)**

| Flexure (mm) | Glass Epoxy Survival Rate (%) | Paper Phenol Survival Rate (%) |
|--------------|-------------------------------|--------------------------------|
| 0            | 100                           | 100                            |
| 2            | 100                           | 100                            |
| 3            | 100                           | 100                            |
| 4            | 100                           | 100                            |
| 5            | 70                            | 100                            |
| 6            | 20                            | 60                             |
| 7            | 0                             | 20                             |
| 8            | 0                             | 0                              |



## Reference Data

Continued from the preceding page.

### 5. Break Strength

#### (1) Test Method

Place the chip on a steel plate as illustrated on the right. Increase load applied to a point near the center of the test sample.

#### (2) Test Samples

GRM21 5C/R7/F5 Characteristics  
GRM31 5C/R7/F5 Characteristics

#### (3) Acceptance Criteria

Define the load that has caused the chip to break or crack, as the bending force.

#### (4) Explanation

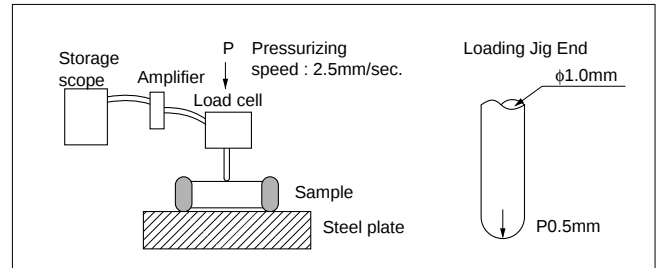
Break strength, P, is proportionate to the square of the thickness of the ceramic element and is expressed as a curve of secondary degree.

The formula is:

$$P = \frac{2\gamma WT^2}{3L} \quad (\text{N})$$

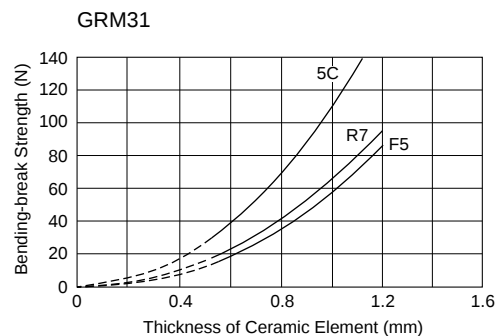
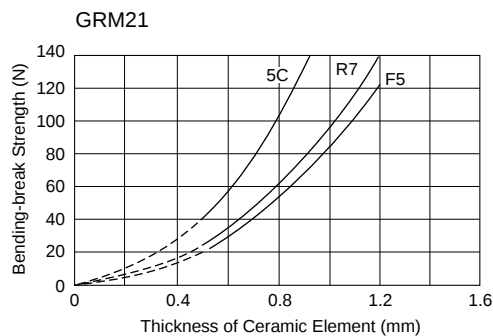
W : Width of ceramic element (mm)  
T : Thickness of element (mm)  
L : Distance between fulcrums (mm)  
 $\gamma$  : Bending stress (N/mm<sup>2</sup>)

#### (5) Results



| Chip Size | L   | W   | $\gamma$                |                         |                         |
|-----------|-----|-----|-------------------------|-------------------------|-------------------------|
|           |     |     | 5C Charac-<br>teristics | R7 Charac-<br>teristics | F5 Charac-<br>teristics |
| GRM21     | 1.5 | 1.2 | 300                     | 180                     | 160                     |
| GRM31     | 2.7 | 1.5 |                         |                         |                         |

(in mm)



### 6. Thermal Shock

#### (1) Test method

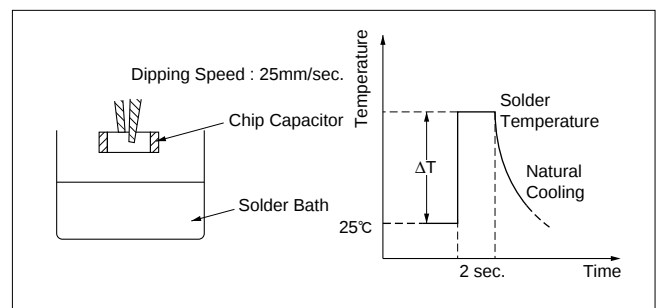
After applying flux (an ethanol solution of 25% rosin), dip the chip in a solder bath (6X4 eutectic solder) in accordance with the following conditions:

#### (2) Test samples

GRM21 5C/R7/F5 Characteristics T=0.6mm typical

#### (3) Acceptance criteria

Visually inspect the test sample with a 60-power optical microscope. Chips exhibiting breaks or cracks should be determined to be defective.



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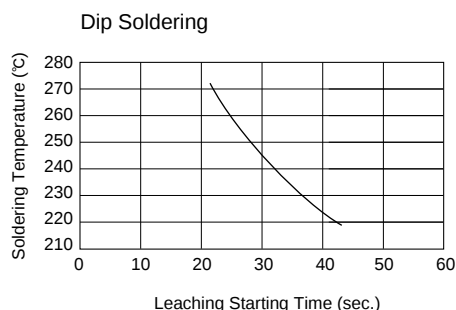
The graph plots the Incidence of Cracks (%) on the y-axis (0 to 100) against the Temperature Differential  $\Delta T$  (°C) on the x-axis (200 to 360). Three curves are shown for different concrete strengths: F5, R7, and 5C. All curves show an increase in crack incidence as the temperature differential increases, with F5 having the highest incidence and 5C the lowest.

| Temperature Differential $\Delta T$ (°C) | F5 Incidence (%) | R7 Incidence (%) | 5C Incidence (%) |
|------------------------------------------|------------------|------------------|------------------|
| 200                                      | 0                | 0                | 0                |
| 240                                      | 0                | 0                | 0                |
| 280                                      | 0                | 0                | 0                |
| 320                                      | 15               | 10               | 2                |
| 360                                      | 45               | 25               | 10               |

A 3D perspective diagram of a rectangular fuel cell. The top surface is labeled 'A', the bottom surface is labeled 'D', the left vertical face is labeled 'B', and the right vertical face is labeled 'C'. A grey, irregularly shaped region is shown on the right vertical face (C), representing the 'Outer Electrode'. An arrow points from the text 'Outer Electrode' to this grey region.

**Flow Soldering**

| Leaching Starting Time (sec.) | Soldering Temperature (°C) |
|-------------------------------|----------------------------|
| 15                            | 270                        |
| 30                            | 220                        |



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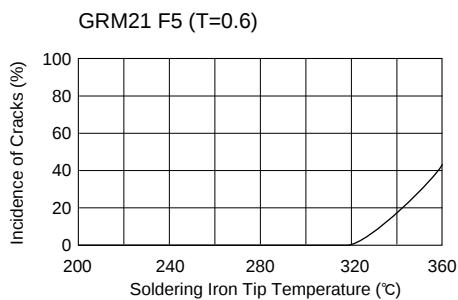
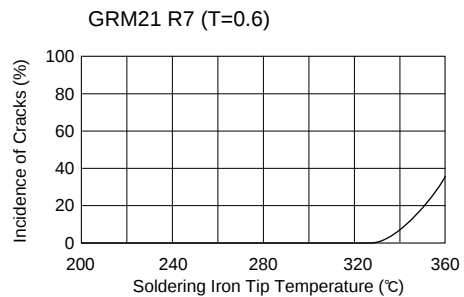
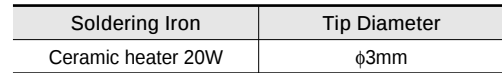
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### (1) Test Method

## (2) Test Samples

### (3) Acceptance Criteria for Defects

#### (4) Results



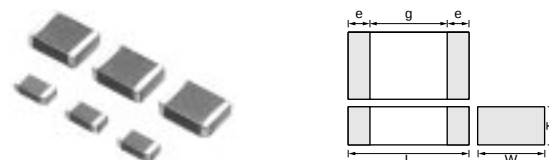
# Chip Monolithic Ceramic Capacitors



## Medium Voltage Low Dissipation Factor

### ■ Features

1. Low-loss and suitable for high frequency circuits
2. Murata's original internal electrode structure realizes high flash-over voltage.
3. A new monolithic structure for small, surface-mountable devices capable of operating at high voltage levels
4. Sn-plated external electrodes realize good solderability.
5. Use the GRM21/31 type with flow or reflow soldering, and other types with reflow soldering only.



| Part Number | Dimensions (mm) |           |               |        |        |
|-------------|-----------------|-----------|---------------|--------|--------|
|             | L               | W         | T             | e min. | g min. |
| GRM21A      | 2.0 ±0.2        | 1.25 ±0.2 | 1.0 +0, -0.3  | 0.3    | 0.7    |
| GRM31A      | 3.2 ±0.2        | 1.6 ±0.2  | 1.25 +0, -0.3 |        | 1.5*   |
| GRM31B      |                 |           | 1.0 +0, -0.3  |        |        |
| GRM32A      | 3.2 ±0.2        | 2.5 ±0.2  | 1.25 +0, -0.3 |        |        |
| GRM32B      |                 |           | 1.0 +0, -0.3  |        |        |
| GRM42A      | 4.5 ±0.3        | 2.0 ±0.2  | 1.0 +0, -0.3  |        | 2.9    |

\* GRM31A7U3D, GRM32A7U3D, GRM32B7U3D : 1.8mm min.

### ■ Applications

Ideal for use on high frequency pulse circuits such as snubber circuits for switching power supplies, DC-DC converters, ballasts (inverter fluorescent lamps), etc.

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

\*: In case of use C0G char., DC630V product with pulse voltage, be sure not to use with 10kHz and less pulse or ripple voltage condition. and these product are not suitable for commercial power line voltage application, such as AC filter. For those applications, be sure to use AC voltage rating product.(GA2/GA3 series)

### C0G Characteristics

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM31A5C2J101JW01D | DC630             | C0G (EIA)          | 100 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J121JW01D | DC630             | C0G (EIA)          | 120 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J151JW01D | DC630             | C0G (EIA)          | 150 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J181JW01D | DC630             | C0G (EIA)          | 180 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J221JW01D | DC630             | C0G (EIA)          | 220 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J271JW01D | DC630             | C0G (EIA)          | 270 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J331JW01D | DC630             | C0G (EIA)          | 330 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J391JW01D | DC630             | C0G (EIA)          | 390 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J471JW01D | DC630             | C0G (EIA)          | 470 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A5C2J561JW01D | DC630             | C0G (EIA)          | 560 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31B5C2J681JW01L | DC630             | C0G (EIA)          | 680 ±5%          | 3.2           | 1.6          | 1.25             | 1.5                   | 0.3 min.         |
| GRM31B5C2J821JW01L | DC630             | C0G (EIA)          | 820 ±5%          | 3.2           | 1.6          | 1.25             | 1.5                   | 0.3 min.         |
| GRM31B5C2J102JW01L | DC630             | C0G (EIA)          | 1000 ±5%         | 3.2           | 1.6          | 1.25             | 1.5                   | 0.3 min.         |

## U2J Characteristics

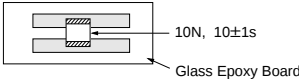
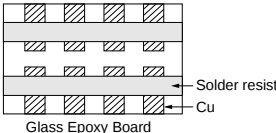
| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM21A7U2E101JW31D | DC250             | U2J (EIA)          | 100 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E121JW31D | DC250             | U2J (EIA)          | 120 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E151JW31D | DC250             | U2J (EIA)          | 150 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E181JW31D | DC250             | U2J (EIA)          | 180 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E221JW31D | DC250             | U2J (EIA)          | 220 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E271JW31D | DC250             | U2J (EIA)          | 270 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E331JW31D | DC250             | U2J (EIA)          | 330 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E391JW31D | DC250             | U2J (EIA)          | 390 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E471JW31D | DC250             | U2J (EIA)          | 470 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E561JW31D | DC250             | U2J (EIA)          | 560 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E681JW31D | DC250             | U2J (EIA)          | 680 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E821JW31D | DC250             | U2J (EIA)          | 820 ±5%          | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E102JW31D | DC250             | U2J (EIA)          | 1000 ±5%         | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E122JW31D | DC250             | U2J (EIA)          | 1200 ±5%         | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E152JW31D | DC250             | U2J (EIA)          | 1500 ±5%         | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E182JW31D | DC250             | U2J (EIA)          | 1800 ±5%         | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21A7U2E222JW31D | DC250             | U2J (EIA)          | 2200 ±5%         | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM31A7U2E272JW31D | DC250             | U2J (EIA)          | 2700 ±5%         | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2E332JW31D | DC250             | U2J (EIA)          | 3300 ±5%         | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2E392JW31D | DC250             | U2J (EIA)          | 3900 ±5%         | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2E472JW31D | DC250             | U2J (EIA)          | 4700 ±5%         | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2E562JW31D | DC250             | U2J (EIA)          | 5600 ±5%         | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31B7U2E682JW31L | DC250             | U2J (EIA)          | 6800 ±5%         | 3.2           | 1.6          | 1.25             | 1.5                   | 0.3 min.         |
| GRM31B7U2E822JW31L | DC250             | U2J (EIA)          | 8200 ±5%         | 3.2           | 1.6          | 1.25             | 1.5                   | 0.3 min.         |
| GRM31B7U2E103JW31L | DC250             | U2J (EIA)          | 10000 ±5%        | 3.2           | 1.6          | 1.25             | 1.5                   | 0.3 min.         |
| GRM31A7U2J100JW31D | DC630             | U2J (EIA)          | 10 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J120JW31D | DC630             | U2J (EIA)          | 12 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J150JW31D | DC630             | U2J (EIA)          | 15 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J180JW31D | DC630             | U2J (EIA)          | 18 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J220JW31D | DC630             | U2J (EIA)          | 22 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J270JW31D | DC630             | U2J (EIA)          | 27 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J330JW31D | DC630             | U2J (EIA)          | 33 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J390JW31D | DC630             | U2J (EIA)          | 39 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J470JW31D | DC630             | U2J (EIA)          | 47 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J560JW31D | DC630             | U2J (EIA)          | 56 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J680JW31D | DC630             | U2J (EIA)          | 68 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J820JW31D | DC630             | U2J (EIA)          | 82 ±5%           | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J101JW31D | DC630             | U2J (EIA)          | 100 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J121JW31D | DC630             | U2J (EIA)          | 120 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J151JW31D | DC630             | U2J (EIA)          | 150 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J181JW31D | DC630             | U2J (EIA)          | 180 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J221JW31D | DC630             | U2J (EIA)          | 220 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J271JW31D | DC630             | U2J (EIA)          | 270 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J331JW31D | DC630             | U2J (EIA)          | 330 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J391JW31D | DC630             | U2J (EIA)          | 390 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J471JW31D | DC630             | U2J (EIA)          | 470 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J561JW31D | DC630             | U2J (EIA)          | 560 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J681JW31D | DC630             | U2J (EIA)          | 680 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J821JW31D | DC630             | U2J (EIA)          | 820 ±5%          | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM31A7U2J102JW31D | DC630             | U2J (EIA)          | 1000 ±5%         | 3.2           | 1.6          | 1.0              | 1.5                   | 0.3 min.         |
| GRM32A7U2J122JW31D | DC630             | U2J (EIA)          | 1200 ±5%         | 3.2           | 2.5          | 1.0              | 1.5                   | 0.3 min.         |
| GRM32A7U2J152JW31D | DC630             | U2J (EIA)          | 1500 ±5%         | 3.2           | 2.5          | 1.0              | 1.5                   | 0.3 min.         |
| GRM32A7U2J182JW31D | DC630             | U2J (EIA)          | 1800 ±5%         | 3.2           | 2.5          | 1.0              | 1.5                   | 0.3 min.         |
| GRM32A7U2J222JW31D | DC630             | U2J (EIA)          | 2200 ±5%         | 3.2           | 2.5          | 1.0              | 1.5                   | 0.3 min.         |

Continued on the following page. 

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## Specifications and Test Methods

| No.           | Item                                    |                     | Specifications                                                                                                                                                                                                                           | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
|---------------|-----------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|---------|---------------------------|----------|---------------------------|--------------|---------------------------|------------------|------------------------|---|------|
| 1             | Operating Temperature Range             |                     | −55 to +125℃                                                                                                                                                                                                                             | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 2             | Appearance                              |                     | No defects or abnormalities                                                                                                                                                                                                              | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 3             | Dimensions                              |                     | Within the specified dimension                                                                                                                                                                                                           | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 4             | Dielectric Strength                     |                     | No defects or abnormalities                                                                                                                                                                                                              | No failure should be observed when voltage in Table is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA. <table><tr><th>Rated Voltage</th><th>Test Voltage</th></tr><tr><td>DC250V</td><td>200% of the rated voltage</td></tr><tr><td>DC630V</td><td>150% of the rated voltage</td></tr><tr><td>DC1kV, DC2kV</td><td>120% of the rated voltage</td></tr><tr><td>DC3.15kV</td><td>DC4095V</td></tr></table>                                                                                                            | Rated Voltage | Test Voltage    | DC250V  | 200% of the rated voltage | DC630V   | 150% of the rated voltage | DC1kV, DC2kV | 120% of the rated voltage | DC3.15kV         | DC4095V                |   |      |
| Rated Voltage | Test Voltage                            |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| DC250V        | 200% of the rated voltage               |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| DC630V        | 150% of the rated voltage               |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| DC1kV, DC2kV  | 120% of the rated voltage               |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| DC3.15kV      | DC4095V                                 |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 5             | Insulation Resistance (I.R.)            |                     | More than 10,000MΩ                                                                                                                                                                                                                       | The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage: DC250V) and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 6             | Capacitance                             |                     | Within the specified tolerance                                                                                                                                                                                                           | The capacitance/Q should be measured at the frequency and voltage shown as follows. <table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>C&lt;1,000pF</td><td>1±0.2MHz</td><td>AC0.5 to 5V(r.m.s.)</td></tr><tr><td>C≥1,000pF</td><td>1±0.2kHz</td><td>AC1±0.2V(r.m.s.)</td></tr></table>                                                                                                                                                                                                                                                             | Capacitance   | Frequency       | Voltage | C<1,000pF                 | 1±0.2MHz | AC0.5 to 5V(r.m.s.)       | C≥1,000pF    | 1±0.2kHz                  | AC1±0.2V(r.m.s.) |                        |   |      |
| Capacitance   | Frequency                               | Voltage             |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| C<1,000pF     | 1±0.2MHz                                | AC0.5 to 5V(r.m.s.) |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| C≥1,000pF     | 1±0.2kHz                                | AC1±0.2V(r.m.s.)    |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 7             | Q                                       |                     | 1,000 min.                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 8             | Capacitance Temperature Characteristics |                     | Temp. Coefficient<br>C0G char. :<br>0±30ppm/℃ (Temp. Range : +25 to +125℃)<br>0+30, −72ppm/℃ (Temp. Range : −55 to +25℃)<br>U2J char. :<br>−750±120ppm/℃ (Temp. Range : +25 to +125℃)<br>−750+120, −347ppm/℃ (Temp. Range : −55 to +25℃) | The capacitance measurement should be made at each step specified in Table. <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table>                                                                                                                                                                                                                                  | Step          | Temperature (℃) | 1       | 25±2                      | 2        | Min. Operating Temp.±3    | 3            | 25±2                      | 4                | Max. Operating Temp.±2 | 5 | 25±2 |
| Step          | Temperature (℃)                         |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 1             | 25±2                                    |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 2             | Min. Operating Temp.±3                  |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 3             | 25±2                                    |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 4             | Max. Operating Temp.±2                  |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 5             | 25±2                                    |                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 9             | Adhesive Strength of Termination        |                     | No removal of the terminations or other defect should occur.                                                                                                                                                                             | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.<br>Then apply 10N force in the direction of the arrow.<br>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. <div></div> <p>Fig. 1</p>                                                                                                                                                          |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
| 10            | Vibration Resistance                    | Appearance          | No defects or abnormalities                                                                                                                                                                                                              | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). <div></div> |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
|               |                                         | Capacitance         | Within the specified tolerance                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |
|               |                                         | Q                   | 1,000 min.                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                 |         |                           |          |                           |              |                           |                  |                        |   |      |

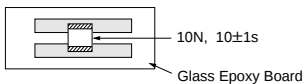
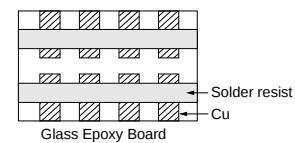


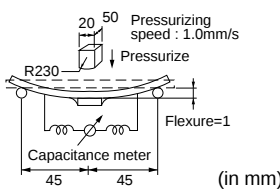
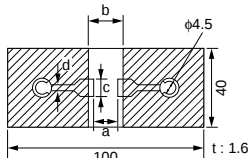
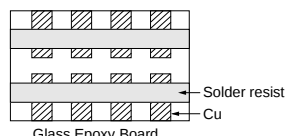
Fig. 1



Continued on the following page.

## Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                         | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Test Method                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|---------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|-------------|---------------------------|--------------------------------|---------------------------|---|--------------|--------|----------|------------------------|------|------|------------|---------|-----|-----|-----|---------|-----|-----|-----|---------|
| 11                  | Deflection                   | No cracking or marking defects should occur.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.</p> <p>Then apply a force in the direction shown in Fig. 3.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p>Fig. 3</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              |  <table><tr><th>LxW (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>2.0X1.25</td><td>1.2</td><td>4.0</td><td>1.65</td><td rowspan="4">1.0</td></tr><tr><td>3.2X1.6</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>3.2X2.5</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>4.5X2.0</td><td>3.5</td><td>7.0</td><td>2.4</td></tr></table> <p>Fig. 2</p> |                                                                                                                                                                                                                                                                                                                                                                                                                          | LxW (mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Dimension (mm) |                  |             |                           |                                | a                         | b | c            | d      | 2.0X1.25 | 1.2                    | 4.0  | 1.65 | 1.0        | 3.2X1.6 | 2.2 | 5.0 | 2.0 | 3.2X2.5 | 2.2 | 5.0 | 2.9 | 4.5X2.0 |
| LxW (mm)            | Dimension (mm)               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     | a                            | b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | c                                                                                                                                                                                                                                                                                                                                                                                                                        | d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 2.0X1.25            | 1.2                          | 4.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.65                                                                                                                                                                                                                                                                                                                                                                                                                     | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 3.2X1.6             | 2.2                          | 5.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 3.2X2.5             | 2.2                          | 5.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.9                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 4.5X2.0             | 3.5                          | 7.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.4                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 12                  | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec.</p> <p>Immersing speed: 25±2.5mm/s</p> <p>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder</p>                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 13                  | Resistance to Soldering Heat | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Preheat the capacitor at 120 to 150°C* for 1 min.</p> <p>Immerse the capacitor in solder solution at 260±5°C for 10±1 sec.</p> <p>Let sit at room condition* for 24±2 hrs., then measure.</p> <p>•Immersing speed: 25±2.5mm/s</p> <p>*Preheating for more than 3.2X2.5mm</p> <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                            | Step           | Temperature      | Time        | 1                         | 100 to 120°C                   | 1 min.                    | 2 | 170 to 200°C | 1 min. |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Temperature                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Time           |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100 to 120°C                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 min.         |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 170 to 200°C                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 min.         |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Within ±2.5%                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| Q                   | 1,000 min.                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| I.R.                | More than 10,000MΩ           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| Dielectric Strength | In accordance with item No.4 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 14                  | Temperature Cycle            | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.</p> <p>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</p> <p>Let sit for 24±2 hrs. at room condition*, then measure.</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table>  <p>Fig. 4</p> | Step           | Temperature (°C) | Time (min.) | 1                         | Min. Operating Temp.±3         | 30±3                      | 2 | Room Temp.   | 2 to 3 | 3        | Max. Operating Temp.±2 | 30±3 | 4    | Room Temp. | 2 to 3  |     |     |     |         |     |     |     |         |
|                     |                              | Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Temperature (°C)                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Time (min.)    |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Min. Operating Temp.±3                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30±3           |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2 to 3         |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Max. Operating Temp.±2                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30±3           |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2 to 3         |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| Capacitance Change  | Within ±2.5%                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| Q                   | 500 min.                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| I.R.                | More than 10,000MΩ           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| Dielectric Strength | In accordance with item No.4 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 15                  | Humidity (Steady State)      | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500±24 hrs.</p> <p>Remove and let sit for 24±2 hrs. at room condition*, then measure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Within ±5.0%                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 350 min.                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | I.R.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | More than 1,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Dielectric Strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| 16                  | Life                         | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Apply voltage as Table for 1,000±48 hrs. at maximum operating temperature ±3°C.</p> <p>Remove and let sit for 24±2 hrs. at room condition*, then measure.</p> <table><tr><th>Rated Voltage</th><th>Applied Voltage</th></tr><tr><td>DC250V</td><td>150% of the rated voltage</td></tr><tr><td>DC630V, DC1kV, DC2kV, DC3.15kV</td><td>120% of the rated voltage</td></tr></table> <p>The charge/discharge current is less than 50mA.</p>                                                                                                                                                                                                                                      | Rated Voltage  | Applied Voltage  | DC250V      | 150% of the rated voltage | DC630V, DC1kV, DC2kV, DC3.15kV | 120% of the rated voltage |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Rated Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Applied Voltage                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | DC250V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 150% of the rated voltage                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | DC630V, DC1kV, DC2kV, DC3.15kV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 120% of the rated voltage                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Within ±3.0%                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              | Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 350 min.                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| I.R.                | More than 1,000MΩ            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
| Dielectric Strength | In accordance with item No.4 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |
|                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |                           |                                |                           |   |              |        |          |                        |      |      |            |         |     |     |     |         |     |     |     |         |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

# Chip Monolithic Ceramic Capacitors

**muRata**

## Medium Voltage High Capacitance for General Use

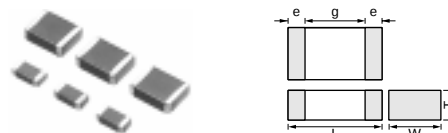
### ■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. Sn-plated external electrodes realizes good solderability.
3. Use the GRM18/21/31 types with flow or reflow soldering, and other types with reflow soldering only.

### ■ Applications

1. Ideal for use on diode-snubber circuits for switching power supplies.
2. Ideal for use as primary-secondary coupling for DC-DC converter.
3. Ideal for use on line filters and ringer detectors for telephones, facsimiles and modems.

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.



| Part Number | Dimensions (mm) |           |              |            |        |
|-------------|-----------------|-----------|--------------|------------|--------|
|             | L               | W         | T            | e          | g min. |
| GRM188      | 1.6 ±0.1        | 0.8 ±0.1  | 0.8 ±0.1     | 0.2 to 0.5 | 0.4    |
| GRM21A      | 2.0 ±0.2        | 1.25 ±0.2 | 1.0 +0,-0.3  | 0.3 min.   | 0.7    |
| GRM21B      |                 |           | 1.25 ±0.2    |            |        |
| GRM31B      | 3.2 ±0.2        | 1.6 ±0.2  | 1.25 +0,-0.3 |            | 1.2    |
| GRM31C      |                 |           | 1.6 ±0.2     |            |        |
| GRM32Q      | 3.2 ±0.3        | 2.5 ±0.2  | 1.5 +0,-0.3  |            |        |
| GRM32D      |                 |           | 2.0 +0,-0.3  |            |        |
| GRM43Q      | 4.5 ±0.4        | 3.2 ±0.3  | 1.5 +0,-0.3  | 0.3 min.   | 2.2    |
| GRM43D      |                 |           | 2.0 +0,-0.3  |            |        |
| GRM55D      | 5.7 ±0.4        | 5.0 ±0.4  | 2.0 +0,-0.3  |            | 3.2    |

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance  | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|--------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM188R72E221KW07D | DC250             | X7R (EIA)          | 220pF ±10%   | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM188R72E331KW07D | DC250             | X7R (EIA)          | 330pF ±10%   | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM188R72E471KW07D | DC250             | X7R (EIA)          | 470pF ±10%   | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM188R72E681KW07D | DC250             | X7R (EIA)          | 680pF ±10%   | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM188R72E102KW07D | DC250             | X7R (EIA)          | 1000pF ±10%  | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM21AR72E102KW01D | DC250             | X7R (EIA)          | 1000pF ±10%  | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM188R72E152KW07D | DC250             | X7R (EIA)          | 1500pF ±10%  | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM21AR72E152KW01D | DC250             | X7R (EIA)          | 1500pF ±10%  | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM188R72E222KW07D | DC250             | X7R (EIA)          | 2200pF ±10%  | 1.6           | 0.8          | 0.8              | 0.4                   | 0.2 to 0.5       |
| GRM21AR72E222KW01D | DC250             | X7R (EIA)          | 2200pF ±10%  | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21AR72E332KW01D | DC250             | X7R (EIA)          | 3300pF ±10%  | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21AR72E472KW01D | DC250             | X7R (EIA)          | 4700pF ±10%  | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21AR72E682KW01D | DC250             | X7R (EIA)          | 6800pF ±10%  | 2.0           | 1.25         | 1.0              | 0.7                   | 0.3 min.         |
| GRM21BR72E103KW03L | DC250             | X7R (EIA)          | 10000pF ±10% | 2.0           | 1.25         | 1.25             | 0.7                   | 0.3 min.         |
| GRM31BR72E153KW01L | DC250             | X7R (EIA)          | 15000pF ±10% | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72E223KW01L | DC250             | X7R (EIA)          | 22000pF ±10% | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31CR72E333KW03L | DC250             | X7R (EIA)          | 33000pF ±10% | 3.2           | 1.6          | 1.6              | 1.2                   | 0.3 min.         |
| GRM31CR72E473KW03L | DC250             | X7R (EIA)          | 47000pF ±10% | 3.2           | 1.6          | 1.6              | 1.2                   | 0.3 min.         |
| GRM31BR72E683KW01L | DC250             | X7R (EIA)          | 68000pF ±10% | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM32QR72E683KW01L | DC250             | X7R (EIA)          | 68000pF ±10% | 3.2           | 2.5          | 1.5              | 1.2                   | 0.3 min.         |
| GRM31CR72E104KW03L | DC250             | X7R (EIA)          | 0.10μF ±10%  | 3.2           | 1.6          | 1.6              | 1.2                   | 0.3 min.         |
| GRM32DR72E104KW01L | DC250             | X7R (EIA)          | 0.10μF ±10%  | 3.2           | 2.5          | 2.0              | 1.2                   | 0.3 min.         |
| GRM32QR72E154KW01L | DC250             | X7R (EIA)          | 0.15μF ±10%  | 3.2           | 2.5          | 1.5              | 1.2                   | 0.3 min.         |
| GRM43QR72E154KW01L | DC250             | X7R (EIA)          | 0.15μF ±10%  | 4.5           | 3.2          | 1.5              | 2.2                   | 0.3 min.         |

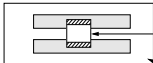
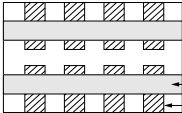
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| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance  | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|--------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM32DR72E224KW01L | DC250             | X7R (EIA)          | 0.22μF ±10%  | 3.2           | 2.5          | 2.0              | 1.2                   | 0.3 min.         |
| GRM43DR72E224KW01L | DC250             | X7R (EIA)          | 0.22μF ±10%  | 4.5           | 3.2          | 2.0              | 2.2                   | 0.3 min.         |
| GRM43DR72E334KW01L | DC250             | X7R (EIA)          | 0.33μF ±10%  | 4.5           | 3.2          | 2.0              | 2.2                   | 0.3 min.         |
| GRM55DR72E334KW01L | DC250             | X7R (EIA)          | 0.33μF ±10%  | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |
| GRM43DR72E474KW01L | DC250             | X7R (EIA)          | 0.47μF ±10%  | 4.5           | 3.2          | 2.0              | 2.2                   | 0.3 min.         |
| GRM55DR72E474KW01L | DC250             | X7R (EIA)          | 0.47μF ±10%  | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |
| GRM55DR72E105KW01L | DC250             | X7R (EIA)          | 1.0μF ±10%   | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |
| GRM31BR72J102KW01L | DC630             | X7R (EIA)          | 1000pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72J152KW01L | DC630             | X7R (EIA)          | 1500pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72J222KW01L | DC630             | X7R (EIA)          | 2200pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72J332KW01L | DC630             | X7R (EIA)          | 3300pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72J472KW01L | DC630             | X7R (EIA)          | 4700pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72J682KW01L | DC630             | X7R (EIA)          | 6800pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR72J103KW01L | DC630             | X7R (EIA)          | 10000pF ±10% | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31CR72J153KW03L | DC630             | X7R (EIA)          | 15000pF ±10% | 3.2           | 1.6          | 1.6              | 1.2                   | 0.3 min.         |
| GRM32QR72J223KW01L | DC630             | X7R (EIA)          | 22000pF ±10% | 3.2           | 2.5          | 1.5              | 1.2                   | 0.3 min.         |
| GRM32DR72J333KW01L | DC630             | X7R (EIA)          | 33000pF ±10% | 3.2           | 2.5          | 2.0              | 1.2                   | 0.3 min.         |
| GRM32DR72J473KW01L | DC630             | X7R (EIA)          | 47000pF ±10% | 3.2           | 2.5          | 2.0              | 1.2                   | 0.3 min.         |
| GRM43QR72J683KW01L | DC630             | X7R (EIA)          | 68000pF ±10% | 4.5           | 3.2          | 1.5              | 2.2                   | 0.3 min.         |
| GRM43DR72J104KW01L | DC630             | X7R (EIA)          | 0.10μF ±10%  | 4.5           | 3.2          | 2.0              | 2.2                   | 0.3 min.         |
| GRM55DR72J154KW01L | DC630             | X7R (EIA)          | 0.15μF ±10%  | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |
| GRM55DR72J224KW01L | DC630             | X7R (EIA)          | 0.22μF ±10%  | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |
| GRM31BR73A471KW01L | DC1000            | X7R (EIA)          | 470pF ±10%   | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR73A102KW01L | DC1000            | X7R (EIA)          | 1000pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR73A152KW01L | DC1000            | X7R (EIA)          | 1500pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR73A222KW01L | DC1000            | X7R (EIA)          | 2200pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR73A332KW01L | DC1000            | X7R (EIA)          | 3300pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM31BR73A472KW01L | DC1000            | X7R (EIA)          | 4700pF ±10%  | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GRM32QR73A682KW01L | DC1000            | X7R (EIA)          | 6800pF ±10%  | 3.2           | 2.5          | 1.5              | 1.2                   | 0.3 min.         |
| GRM32QR73A103KW01L | DC1000            | X7R (EIA)          | 10000pF ±10% | 3.2           | 2.5          | 1.5              | 1.2                   | 0.3 min.         |
| GRM32DR73A153KW01L | DC1000            | X7R (EIA)          | 15000pF ±10% | 3.2           | 2.5          | 2.0              | 1.2                   | 0.3 min.         |
| GRM32DR73A223KW01L | DC1000            | X7R (EIA)          | 22000pF ±10% | 3.2           | 2.5          | 2.0              | 1.2                   | 0.3 min.         |
| GRM43DR73A333KW01L | DC1000            | X7R (EIA)          | 33000pF ±10% | 4.5           | 3.2          | 2.0              | 2.2                   | 0.3 min.         |
| GRM43DR73A473KW01L | DC1000            | X7R (EIA)          | 47000pF ±10% | 4.5           | 3.2          | 2.0              | 2.2                   | 0.3 min.         |
| GRM55DR73A104KW01L | DC1000            | X7R (EIA)          | 0.10μF ±10%  | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |

## Specifications and Test Methods

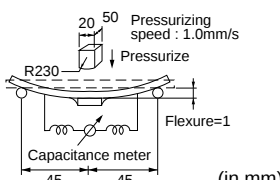
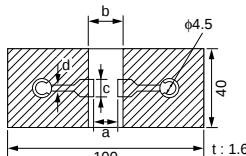
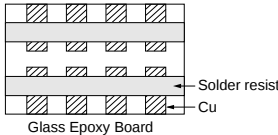
| No.  | Item                                    |             | Specifications                                                 | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |                 |   |      |   |                        |   |      |   |                        |   |      |
|------|-----------------------------------------|-------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------|---|------|---|------------------------|---|------|---|------------------------|---|------|
| 1    | Operating Temperature Range             |             | −55 to +125℃                                                   | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 2    | Appearance                              |             | No defects or abnormalities                                    | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 3    | Dimensions                              |             | Within the specified dimensions                                | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 4    | Dielectric Strength                     |             | No defects or abnormalities                                    | No failure should be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage: DC250V, 120% of the rated voltage in case of rated voltage: DC1kV) is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                      |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 5    | Insulation Resistance (I.R.)            |             | C≥0.01μF: More than 100MΩ • μF<br>C<0.01μF: More than 10,000MΩ | The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage: DC250V) and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 6    | Capacitance                             |             | Within the specified tolerance                                 | The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 7    | Dissipation Factor (D.F.)               |             | 0.025 max.                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 8    | Capacitance Temperature Characteristics |             | Cap. Change Within ±15% (Temp. Range: −55 to +125℃)            | <p>The capacitance measurement should be made at each step specified in Table.</p> <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table> <p>•Pretreatment<br/>Perform a heat treatment at 150 ± 5℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                     | Step | Temperature (℃) | 1 | 25±2 | 2 | Min. Operating Temp.±3 | 3 | 25±2 | 4 | Max. Operating Temp.±2 | 5 | 25±2 |
| Step | Temperature (℃)                         |             |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 1    | 25±2                                    |             |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 2    | Min. Operating Temp.±3                  |             |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 3    | 25±2                                    |             |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 4    | Max. Operating Temp.±2                  |             |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 5    | 25±2                                    |             |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 9    | Adhesive Strength of Termination        |             | No removal of the terminations or other defect should occur.   | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.<br/>Then apply 10N force in the direction of the arrow.<br/>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div><p>10N (5N : Size 1.6×0.8mm only), 10±1s<br/>Glass Epoxy Board</p></div> <p>Fig. 1</p>                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 10   | Vibration Resistance                    | Appearance  | No defects or abnormalities                                    | <p>Solder the capacitor to the test jig (glass epoxy board).<br/>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).</p> <div><p>Solder resist<br/>Cu<br/>Glass Epoxy Board</p></div> |      |                 |   |      |   |                        |   |      |   |                        |   |      |
|      |                                         | Capacitance | Within the specified tolerance                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |
|      |                                         | D.F.        | 0.025 max.                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                 |   |      |   |                        |   |      |   |                        |   |      |

\* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. 

## Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                           |                     | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|---------------------|----------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-------------|---|------------------------|--------|---|--------------|--------|---------|------------------------|------|-----|------------|----------|-----|-----|------|---------|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|
| 11                  | Deflection                                                     |                     | No cracking or marking defects should occur.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.</p> <p>Then apply a force in the direction shown in Fig. 3.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p>Fig. 3</p>                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                |                     |  <table><tr><th rowspan="2">LxW (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>1.6X0.8</td><td>1.0</td><td>3.0</td><td>1.2</td><td rowspan="6">1.0</td></tr><tr><td>2.0X1.25</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>3.2X1.6</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>3.2X2.5</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>4.5X3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7X5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table> <p>Fig. 2</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | LxW (mm)    | Dimension (mm)   |             |   |                        | a      | b | c            | d      | 1.6X0.8 | 1.0                    | 3.0  | 1.2 | 1.0        | 2.0X1.25 | 1.2 | 4.0 | 1.65 | 3.2X1.6 | 2.2 | 5.0 | 2.0 | 3.2X2.5 | 2.2 | 5.0 | 2.9 | 4.5X3.2 | 3.5 | 7.0 | 3.7 |
| LxW (mm)            | Dimension (mm)                                                 |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     | a                                                              | b                   | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 1.6X0.8             | 1.0                                                            | 3.0                 | 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 2.0X1.25            | 1.2                                                            | 4.0                 | 1.65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 3.2X1.6             | 2.2                                                            | 5.0                 | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 3.2X2.5             | 2.2                                                            | 5.0                 | 2.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 4.5X3.2             | 3.5                                                            | 7.0                 | 3.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 5.7X5.0             | 4.5                                                            | 8.0                 | 5.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 12                  | Solderability of Termination                                   |                     | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s</p> <p>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 13                  | Resistance to Soldering Heat                                   | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Preheat the capacitor at 120 to 150°C* for 1 min.</p> <p>Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.</p> <p>•Immersing speed: 25±2.5mm/s</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ±18 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p> <p>*Preheating for more than 3.2X2.5mm</p> <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                                   | Step        | Temperature      | Time        | 1 | 100 to 120°C           | 1 min. | 2 | 170 to 200°C | 1 min. |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | Step                | Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time        |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | 1                   | 100 to 120°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 min.      |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | 2                   | 170 to 200°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 min.      |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | Capacitance Change  | Within ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| D.F.                | 0.025 max.                                                     |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| I.R.                | C≥0.01μF: More than 100MΩ • μF<br>C<0.01μF: More than 10,000MΩ |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| Dielectric Strength | In accordance with item No.4                                   |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 14                  | Temperature Cycle                                              | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.</p> <p>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</p> <p>Let sit for 24±2 hrs. at room condition*, then measure.</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ±18 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>  <p>Fig. 4</p> | Step        | Temperature (°C) | Time (min.) | 1 | Min. Operating Temp.±3 | 30±3   | 2 | Room Temp.   | 2 to 3 | 3       | Max. Operating Temp.±2 | 30±3 | 4   | Room Temp. | 2 to 3   |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | Step                | Temperature (°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time (min.) |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | 1                   | Min. Operating Temp.±3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30±3        |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | 2                   | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2 to 3      |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | 3                   | Max. Operating Temp.±2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30±3        |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 4                   | Room Temp.                                                     | 2 to 3              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| Capacitance Change  | Within ±7.5%                                                   |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| D.F.                | 0.025 max.                                                     |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| I.R.                | C≥0.01μF: More than 100MΩ • μF<br>C<0.01μF: More than 10,000MΩ |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| Dielectric Strength | In accordance with item No.4                                   |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
| 15                  | Humidity (Steady State)                                        | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ±28 hrs.</p> <p>Remove and let sit for 24±2 hrs. at room condition*, then measure.</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ±18 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | Capacitance Change  | Within ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | D.F.                | 0.05 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | I.R.                | C≥0.01μF: More than 10MΩ • μF<br>C<0.01μF: More than 1,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |
|                     |                                                                | Dielectric Strength | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |          |     |     |      |         |     |     |     |         |     |     |     |         |     |     |     |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Specifications and Test Methods



Continued from the preceding page.

| No. | Item                                                   |                     | Specifications                                                                                       | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----|--------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16  | Life                                                   | Appearance          | No marking defects                                                                                   | Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage: DC250V, 110% of the rated voltage in case of rated voltage: DC1kV) for 1,000 $\pm$ 48 hrs. at maximum operating temperature $\pm$ 3°C. Remove and let sit for 24 $\pm$ 2 hrs. at room condition*, then measure.<br>The charge/discharge current is less than 50mA.<br><b>•Pretreatment</b><br>Apply test voltage for 60 $\pm$ 5 min. at test temperature. Remove and let sit for 24 $\pm$ 2 hrs. at room condition*. |
|     |                                                        | Capacitance Change  | Within $\pm$ 15% (rated voltage: DC250V, DC630V)<br>Within $\pm$ 20% (rated voltage: DC1kV)          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                                        | D.F.                | 0.05 max.                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                                        | I.R.                | C $\geq$ 0.01 $\mu$ F: More than 10M $\Omega$ • $\mu$ F<br>C<0.01 $\mu$ F: More than 1,000M $\Omega$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                                        | Dielectric Strength | In accordance with item No.4                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 17  | Humidity Loading<br>(Application: DC250V, DC630V item) | Appearance          | No marking defects                                                                                   | Apply the rated voltage at 40 $\pm$ 2°C and relative humidity of 90 to 95% for 500 $\pm$ 24 hrs.<br>Remove and let sit for 24 $\pm$ 2 hrs. at room condition*, then measure.<br><b>•Pretreatment</b><br>Apply test voltage for 60 $\pm$ 5 min. at test temperature. Remove and let sit for 24 $\pm$ 2 hrs. at room condition*.                                                                                                                                                                            |
|     |                                                        | Capacitance Change  | Within $\pm$ 15%                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                                        | D.F.                | 0.05 max.                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                                        | I.R.                | C $\geq$ 0.01 $\mu$ F: More than 10M $\Omega$ • $\mu$ F<br>C<0.01 $\mu$ F: More than 1,000M $\Omega$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|     |                                                        | Dielectric Strength | In accordance with item No.4                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

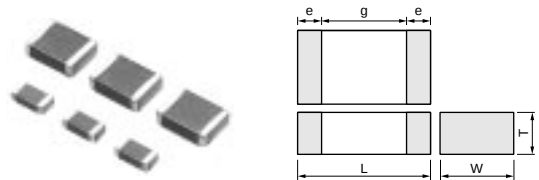
# Chip Monolithic Ceramic Capacitors



## Only for LCD Backlight Inverter Circuit

### ■ Features

1. Low-loss and suitable for high frequency circuits
2. Murata's original internal electrode structure realizes high flash-over voltage.
3. A new monolithic structure for small, surface-mountable devices capable of operating at high voltage levels.
4. Sn-plated external electrodes realize good solderability.
5. Only for reflow soldering
6. The capacitors less than 22pF can be applied maximum 4.0kV peak to peak at 100kHz or less only for the ballast or the resonance usage in the LCD backlight inverter circuit.



| Part Number | Dimensions (mm) |          |              |        |        |
|-------------|-----------------|----------|--------------|--------|--------|
|             | L               | W        | T            | e min. | g min. |
| GRM42A      | 4.5 ±0.3        | 2.0 ±0.2 | 1.0 +0, -0.3 | 0.3    | 2.9    |

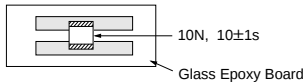
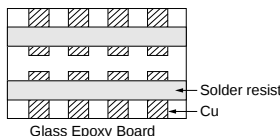
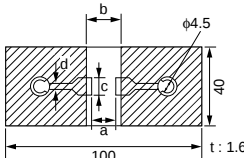
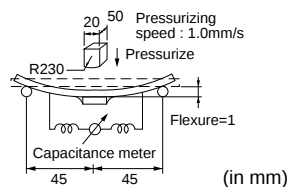
### ■ Applications

Ideal for use as the ballast in LCD backlight inverter.

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM42A5C3F050DW01L | DC3150            | C0G (EIA)          | 5.0 ±0.5pF       | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F100JW01L | DC3150            | C0G (EIA)          | 10 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F120JW01L | DC3150            | C0G (EIA)          | 12 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F150JW01L | DC3150            | C0G (EIA)          | 15 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F180JW01L | DC3150            | C0G (EIA)          | 18 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F220JW01L | DC3150            | C0G (EIA)          | 22 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F270JW01L | DC3150            | C0G (EIA)          | 27 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F330JW01L | DC3150            | C0G (EIA)          | 33 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F390JW01L | DC3150            | C0G (EIA)          | 39 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |
| GRM42A5C3F470JW01L | DC3150            | C0G (EIA)          | 47 ±5%           | 4.5           | 2.0          | 1.0              | 2.9                   | 0.3 min.         |

## Specifications and Test Methods

| No.     | Item                                    | Specifications                                                                                          | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|-----------------------------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|------|---|------------------------|---|------|---|------------------------|-----|------|-----|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Operating Temperature Range             | −55 to +125℃                                                                                            | —                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2       | Appearance                              | No defects or abnormalities                                                                             | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3       | Dimensions                              | Within the specified dimension                                                                          | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 4       | Dielectric Strength                     | No defects or abnormalities                                                                             | No failure should be observed when DC4095V is applied between the terminations for 1 to 5 sec., provided the charge/ discharge current is less than 50mA.                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5       | Insulation Resistance (I.R.)            | More than 10,000MΩ                                                                                      | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 6       | Capacitance                             | Within the specified tolerance                                                                          | The capacitance/Q should be measured at a frequency of 1±0.2MHz and a voltage of AC0.5 to 5V(r.m.s.)                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 7       | Q                                       | 1,000 min.                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 8       | Capacitance Temperature Characteristics | Temp. Coefficient<br>0±30ppm/℃ (Temp. Range: +25 to +125℃)<br>0+30, −72ppm/℃ (Temp. Range: −55 to +25℃) | <p>The capacitance measurement should be made at each step specified in Table.</p> <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table>                                                                                | Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Temperature (℃) | 1 | 25±2 | 2 | Min. Operating Temp.±3 | 3 | 25±2 | 4 | Max. Operating Temp.±2 | 5   | 25±2 |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Step    | Temperature (℃)                         |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1       | 25±2                                    |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2       | Min. Operating Temp.±3                  |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3       | 25±2                                    |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 4       | Max. Operating Temp.±2                  |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5       | 25±2                                    |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 9       | Adhesive Strength of Termination        | No removal of the terminations or other defect should occur.                                            | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.</p> <p>Then apply 10N force in the direction of the arrow.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div><p>Fig. 1</p></div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 10      | Vibration Resistance                    | Appearance                                                                                              | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                                                                         | <p>Solder the capacitor to the test jig (glass epoxy board).</p> <p>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).</p> <div></div> |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|         |                                         | Capacitance                                                                                             | Within the specified tolerance                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|         |                                         | Q                                                                                                       | 1,000 min.                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 11      | Deflection                              | No cracking or marking defects should occur.                                                            | <div><table><tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td>1.0</td></tr></table><p>Fig. 2</p></div>                                                                                                       | L×W (mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Dimension (mm)  |   |      |   | a                      | b | c    | d | 4.5×2.0                | 3.5 | 7.0  | 2.4 | 1.0 | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.</p> <p>Then apply a force in the direction shown in Fig. 3.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div><p>Fig. 3</p></div> |
|         |                                         | L×W (mm)                                                                                                | Dimension (mm)                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| a       | b                                       |                                                                                                         | c                                                                                                                                                                                                                                                                                                                                                                                                                                   | d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 4.5×2.0 | 3.5                                     | 7.0                                                                                                     | 2.4                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |   |      |   |                        |   |      |   |                        |     |      |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                      |

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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

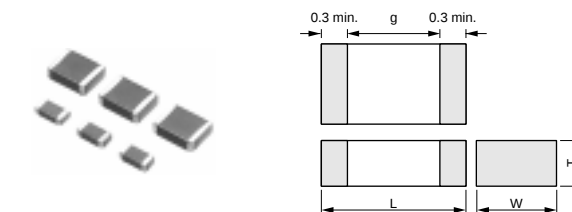
# Chip Monolithic Ceramic Capacitors

**muRata**

## Only for Information Devices

### ■ Features

1. These items are designed specifically for telecommunications devices (IEEE802.3) in Ethernet LAN and primary-secondary coupling for DC-DC converter.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
3. Sn-plated external electrodes realizes good solderability.
4. Only for reflow soldering
5. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.



| Part Number | Dimensions (mm) |          |              |        |
|-------------|-----------------|----------|--------------|--------|
|             | L               | W        | T            | g min. |
| GR442Q      | 4.5 ±0.3        | 2.0 ±0.2 | 1.5 +0, -0.3 | 2.5    |
| GR443D      | 4.5 ±0.4        | 3.2 ±0.3 | 2.0 +0, -0.3 |        |
| GR443Q      |                 |          | 1.5 +0, -0.3 |        |
| GR455D      | 5.7 ±0.4        | 5.0 ±0.4 | 2.0 +0, -0.3 | 3.2    |

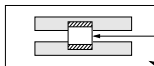
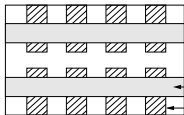
### ■ Applications

1. Ideal for use on telecommunications devices in Ethernet LAN
2. Ideal for use as primary-secondary coupling for DC-DC converter

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GR442QR73D101KW01L | DC2000            | X7R (EIA)          | 100 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D121KW01L | DC2000            | X7R (EIA)          | 120 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D151KW01L | DC2000            | X7R (EIA)          | 150 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D181KW01L | DC2000            | X7R (EIA)          | 180 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D221KW01L | DC2000            | X7R (EIA)          | 220 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D271KW01L | DC2000            | X7R (EIA)          | 270 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D331KW01L | DC2000            | X7R (EIA)          | 330 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D391KW01L | DC2000            | X7R (EIA)          | 390 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D471KW01L | DC2000            | X7R (EIA)          | 470 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D561KW01L | DC2000            | X7R (EIA)          | 560 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D681KW01L | DC2000            | X7R (EIA)          | 680 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D821KW01L | DC2000            | X7R (EIA)          | 820 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D102KW01L | DC2000            | X7R (EIA)          | 1000 ±10%        | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D122KW01L | DC2000            | X7R (EIA)          | 1200 ±10%        | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR442QR73D152KW01L | DC2000            | X7R (EIA)          | 1500 ±10%        | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GR443QR73D182KW01L | DC2000            | X7R (EIA)          | 1800 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GR443QR73D222KW01L | DC2000            | X7R (EIA)          | 2200 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GR443QR73D272KW01L | DC2000            | X7R (EIA)          | 2700 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GR443QR73D332KW01L | DC2000            | X7R (EIA)          | 3300 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GR443QR73D392KW01L | DC2000            | X7R (EIA)          | 3900 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GR443DR73D472KW01L | DC2000            | X7R (EIA)          | 4700 ±10%        | 4.5           | 3.2          | 2.0              | 2.5                   | 0.3 min.         |
| GR455DR73D103KW01L | DC2000            | X7R (EIA)          | 10000 ±10%       | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |

## Specifications and Test Methods

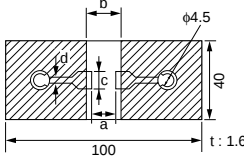
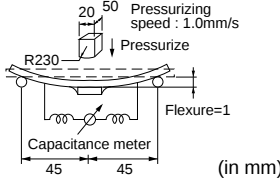
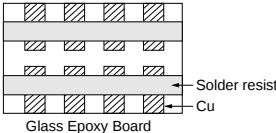
| No.           | Item                                    |             | Specifications                                                               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
|---------------|-----------------------------------------|-------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|------|-------|---------------------------|------------------------|-----------------|-----------|---|------------------------|---|------|
| 1             | Operating Temperature Range             |             | −55 to +125℃                                                                 | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 2             | Appearance                              |             | No defects or abnormalities                                                  | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 3             | Dimensions                              |             | Within the specified dimensions                                              | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 4             | Dielectric Strength                     |             | No defects or abnormalities                                                  | No failure should be observed when voltage in table is applied between the terminations, provided the charge/discharge current is less than 50mA. <table><tr><th>Rated Voltage</th><th>Test Voltage</th><th>Time</th></tr><tr><td rowspan="2">DC2kV</td><td>120% of the rated voltage</td><td>60±1 sec.</td></tr><tr><td>AC1500V(r.m.s.)</td><td>60±1 sec.</td></tr></table>                                                                                                                                                                                                                                                    | Rated Voltage | Test Voltage    | Time | DC2kV | 120% of the rated voltage | 60±1 sec.              | AC1500V(r.m.s.) | 60±1 sec. |   |                        |   |      |
| Rated Voltage | Test Voltage                            | Time        |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| DC2kV         | 120% of the rated voltage               | 60±1 sec.   |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
|               | AC1500V(r.m.s.)                         | 60±1 sec.   |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 5             | Pulse Voltage                           |             | No self healing breakdowns or flash-overs have taken place in the capacitor. | 10 impulse of alternating polarity is subjected.<br>(5 impulse for each polarity)<br>The interval between impulse is 60 sec.<br>Applied Voltage: 2.5kV zero to peak                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 6             | Insulation Resistance (I.R.)            |             | More than 6,000MΩ                                                            | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 7             | Capacitance                             |             | Within the specified tolerance                                               | The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 8             | Dissipation Factor (D.F.)               |             | 0.025 max.                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 9             | Capacitance Temperature Characteristics |             | Cap. Change within ±15%<br>(Temp. Range: −55 to +125℃)                       | The capacitance measurement should be made at each step specified in Table. <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table> <p>•Pretreatment<br/>Perform a heat treatment at 150 ±10.℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                   | Step          | Temperature (℃) | 1    | 25±2  | 2                         | Min. Operating Temp.±3 | 3               | 25±2      | 4 | Max. Operating Temp.±2 | 5 | 25±2 |
| Step          | Temperature (℃)                         |             |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 1             | 25±2                                    |             |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 2             | Min. Operating Temp.±3                  |             |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 3             | 25±2                                    |             |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 4             | Max. Operating Temp.±2                  |             |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 5             | 25±2                                    |             |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 10            | Adhesive Strength of Termination        |             | No removal of the terminations or other defect should occur.                 | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.<br>Then apply 10N force in the direction of the arrow.<br>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. <div><p>10N, 10±1s<br/>Glass Epoxy Board</p></div> <p>Fig. 1</p>                                                                                                                                                                    |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
| 11            | Vibration Resistance                    | Appearance  | No defects or abnormalities                                                  | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). <div><p>Solder resist<br/>Cu<br/>Glass Epoxy Board</p></div> |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
|               |                                         | Capacitance | Within the specified tolerance                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |
|               |                                         | D.F.        | 0.025 max.                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                 |      |       |                           |                        |                 |           |   |                        |   |      |

\* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. 

## Specifications and Test Methods

Continued from the preceding page.

| No.     | Item                         | Specifications                                                      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|---------|------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|-------------|---|------------------------|--------|---|--------------|--------|---|------------------------|------|-----|------------|--------|---------|-----|-----|-----|---------|-----|-----|-----|
| 12      | Deflection                   | No cracking or marking defects should occur.                        | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.</p> <p>Then apply a force in the direction shown in Fig. 3.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div><table data-bbox="368 486 877 609"><tr><th>L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="3">1.0</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table><p>Fig. 2</p><div><p>Fig. 3</p></div></div> | L×W (mm)       | Dimension (mm)   |             |   |                        |        | a | b            | c      | d | 4.5×2.0                | 3.5  | 7.0 | 2.4        | 1.0    | 4.5×3.2 | 3.5 | 7.0 | 3.7 | 5.7×5.0 | 4.5 | 8.0 | 5.6 |
|         |                              | L×W (mm)                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Dimension (mm) |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         | a                            | b                                                                   | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | d              |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 4.5×2.0 | 3.5                          | 7.0                                                                 | 2.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.0            |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 4.5×3.2 | 3.5                          | 7.0                                                                 | 3.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 5.7×5.0 | 4.5                          | 8.0                                                                 | 5.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              |                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 13      | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously. | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec.</p> <p>Immersing speed: 25±2.5mm/s</p> <p>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 14      | Resistance to Soldering Heat | Appearance                                                          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | Capacitance Change                                                  | Within ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | D.F.                                                                | 0.025 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | I.R.                                                                | More than 1,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | Dielectric Strength                                                 | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              |                                                                     | <p>Preheat the capacitor as table.</p> <p>Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.</p> <p>•Immersing speed: 25±2.5mm/s</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150±18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p> <p>*Preheating</p> <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                        | Step           | Temperature      | Time        | 1 | 100 to 120°C           | 1 min. | 2 | 170 to 200°C | 1 min. |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| Step    | Temperature                  | Time                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 1       | 100 to 120°C                 | 1 min.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 2       | 170 to 200°C                 | 1 min.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 15      | Temperature Cycle            | Appearance                                                          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | Capacitance Change                                                  | Within ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | D.F.                                                                | 0.05 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | I.R.                                                                | More than 3,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | Dielectric Strength                                                 | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              |                                                                     | <p>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.</p> <p>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</p> <p>Let sit for 24±2 hrs. at room condition*, then measure.</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table> <p>•Pretreatment</p> <p>Perform a heat treatment at 150±18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p> <div><p>Fig. 4</p></div>                                                                                                  | Step           | Temperature (°C) | Time (min.) | 1 | Min. Operating Temp.±3 | 30±3   | 2 | Room Temp.   | 2 to 3 | 3 | Max. Operating Temp.±2 | 30±3 | 4   | Room Temp. | 2 to 3 |         |     |     |     |         |     |     |     |
| Step    | Temperature (°C)             | Time (min.)                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 1       | Min. Operating Temp.±3       | 30±3                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 2       | Room Temp.                   | 2 to 3                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 3       | Max. Operating Temp.±2       | 30±3                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 4       | Room Temp.                   | 2 to 3                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
| 16      | Humidity (Steady State)      | Appearance                                                          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | Capacitance Change                                                  | Within ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | D.F.                                                                | 0.05 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | I.R.                                                                | More than 1,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              | Dielectric Strength                                                 | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |
|         |                              |                                                                     | <p>Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500±20 hrs.</p> <p>Remove and let sit for 24±2 hrs. at room condition*, then measure.</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150±18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  |             |   |                        |        |   |              |        |   |                        |      |     |            |        |         |     |     |     |         |     |     |     |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

## Specifications and Test Methods

 Continued from the preceding page.

| No. | Item | Specifications      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----|------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17  | Life | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|     |      | Capacitance Change  | Within $\pm 20\%$                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|     |      | D.F.                | 0.05 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|     |      | I.R.                | More than 2,000M $\Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|     |      | Dielectric Strength | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|     |      |                     | <p>Apply 110% of the rated voltage for 1,000<math>\pm 48</math> hrs. at maximum operating temperature <math>\pm 3^{\circ}\text{C}</math>. Remove and let sit for 24<math>\pm 2</math> hrs. at room condition*, then measure.</p> <p>The charge/discharge current is less than 50mA.</p> <p>•Pretreatment</p> <p>Apply test voltage for 60<math>\pm 5</math> min. at test temperature. Remove and let sit for 24<math>\pm 2</math> hrs. at room condition*.</p> |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors



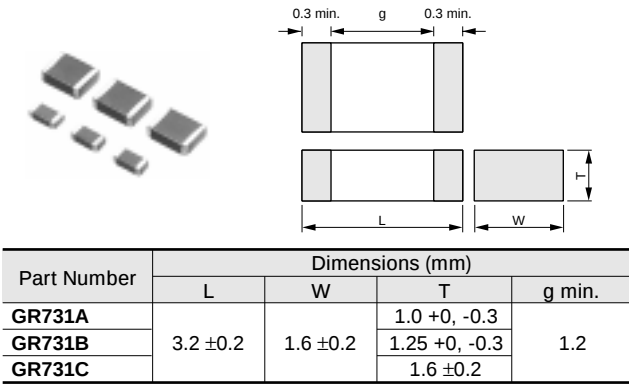
Only for Camera Flash Circuit

■ Features

- 1. Suitable for the trigger of the flash circuit, because real capacitance is stable during operating voltage.
- 2. The thin type fit for thinner camera.
- 3. Sn-plated external electrodes realizes good solderability.
- 4. For flow and reflow soldering

■ Applications

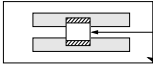
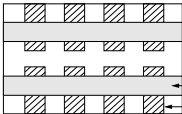
For strobe circuit

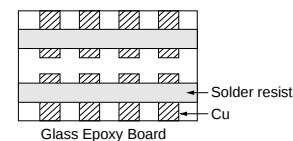


Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as Ågfor Automotive useÅh on its catalog can be used for automobile applications such as Power train and Safety equipment.

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GR731AW0BB103KW01D | DC350             | -                  | 10000 ±10%       | 3.2           | 1.6          | 1.0              | 1.2                   | 0.3 min.         |
| GR731AW0BB153KW01D | DC350             | -                  | 15000 ±10%       | 3.2           | 1.6          | 1.0              | 1.2                   | 0.3 min.         |
| GR731BW0BB223KW01L | DC350             | -                  | 22000 ±10%       | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GR731BW0BB333KW01L | DC350             | -                  | 33000 ±10%       | 3.2           | 1.6          | 1.25             | 1.2                   | 0.3 min.         |
| GR731CW0BB473KW03L | DC350             | -                  | 47000 ±10%       | 3.2           | 1.6          | 1.6              | 1.2                   | 0.3 min.         |

## Specifications and Test Methods

| No.  | Item                                    |             | Specifications                                                                                              | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |                 |   |      |   |                        |   |      |   |                        |   |      |
|------|-----------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------|---|------|---|------------------------|---|------|---|------------------------|---|------|
| 1    | Operating Temperature Range             |             | −55 to +125℃                                                                                                | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 2    | Appearance                              |             | No defects or abnormalities                                                                                 | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 3    | Dimensions                              |             | Within the specified dimensions                                                                             | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 4    | Dielectric Strength                     |             | No defects or abnormalities                                                                                 | No failure should be observed when DC500V is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 5    | Insulation Resistance (I.R.)            |             | C≥0.01μF: More than 100MΩ • μF<br>C<0.01μF: More than 10,000MΩ                                              | The insulation resistance should be measured with DC250±50V and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 6    | Capacitance                             |             | Within the specified tolerance                                                                              | The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 7    | Dissipation Factor (D.F.)               |             | 0.025 max.                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 8    | Capacitance Temperature Characteristics |             | Cap. Change<br>Within ±10% (Apply DC350V bias)<br>Within ±33 % (No DC bias)<br>(Temp. Range : −55 to +125℃) | <p>The capacitance measurement should be made at each step specified in Table.</p> <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table> <p>•Pretreatment<br/>Perform a heat treatment at 150 ±5.0 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                         | Step | Temperature (℃) | 1 | 25±2 | 2 | Min. Operating Temp.±3 | 3 | 25±2 | 4 | Max. Operating Temp.±2 | 5 | 25±2 |
| Step | Temperature (℃)                         |             |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 1    | 25±2                                    |             |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 2    | Min. Operating Temp.±3                  |             |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 3    | 25±2                                    |             |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 4    | Max. Operating Temp.±2                  |             |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 5    | 25±2                                    |             |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 9    | Adhesive Strength of Termination        |             | No removal of the terminations or other defect should occur.                                                | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.</p> <p>Then apply 10N force in the direction of the arrow.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div><p>10N, 10±1s</p><p>Glass Epoxy Board</p></div> <p>Fig. 1</p>                                                                                                                                                                  |      |                 |   |      |   |                        |   |      |   |                        |   |      |
| 10   | Vibration Resistance                    | Appearance  | No defects or abnormalities                                                                                 | <p>Solder the capacitor to the test jig (glass epoxy board).</p> <p>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).</p> <div><p>Solder resist</p><p>Cu</p><p>Glass Epoxy Board</p></div> |      |                 |   |      |   |                        |   |      |   |                        |   |      |
|      |                                         | Capacitance | Within the specified tolerance                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |
|      |                                         | D.F.        | 0.025 max.                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                 |   |      |   |                        |   |      |   |                        |   |      |

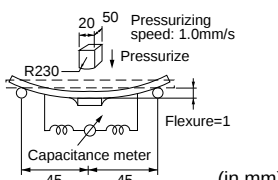
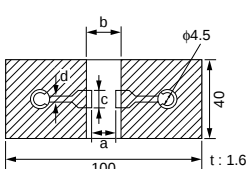
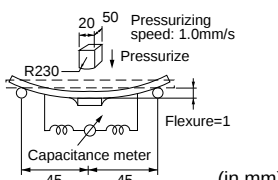


\* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

## Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                           |                     | Specifications                                                                                                                                                                                                                                                                                                             | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|---------------------|----------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-------------|---|------------------------|------|---|------------|--------|---|------------------------|------|-----|------------|--------|
| 11                  | Deflection                                                     |                     | No cracking or marking defects should occur.                                                                                                                                                                                                                                                                               | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.</p> <p>Then apply a force in the direction shown in Fig. 3.</p> <p>The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div></div> <p>(in mm)</p> <p>Fig. 3</p>                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                |                     | <div></div> <table><tr><th>LxW (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>3.2×1.6</td><td>2.2</td><td>5.0</td><td>2.0</td><td>1.0</td></tr></table> <p>Fig. 2</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | LxW (mm)    | Dimension (mm)   |             |   |                        |      | a | b          | c      | d | 3.2×1.6                | 2.2  | 5.0 | 2.0        | 1.0    |
| LxW (mm)            | Dimension (mm)                                                 |                     |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     | a                                                              | b                   | c                                                                                                                                                                                                                                                                                                                          | d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| 3.2×1.6             | 2.2                                                            | 5.0                 | 2.0                                                                                                                                                                                                                                                                                                                        | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| 12                  | Solderability of Termination                                   |                     | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                        | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).</p> <p>Immerse in solder solution for 2±0.5 sec.</p> <p>Immersing speed: 25±2.5mm/s</p> <p>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)</p> <p>235±5°C H60A or H63A Eutectic Solder</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| 13                  | Resistance to Soldering Heat                                   | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                         | <p>Preheat the capacitor at 120 to 150°C* for 1 min.</p> <p>Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.</p> <p>•Immersing speed: 25±2.5mm/s</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ±<sub>1</sub>8 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | Capacitance Change  | Within ±10%                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | D.F.                | 0.025 max.                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | I.R.                | C≥0.01μF: More than 100MΩ • μF<br>C<0.01μF: More than 10,000MΩ                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | Dielectric Strength | In accordance with item No.4                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| 14                  | Temperature Cycle                                              | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                         | <p>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.</p> <p>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</p> <p>Let sit for 24±2 hrs. at room condition*, then measure.</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ±<sub>1</sub>8 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p> <div></div> <p>(in mm)</p> <p>Fig. 4</p> | Step        | Temperature (°C) | Time (min.) | 1 | Min. Operating Temp.±3 | 30±3 | 2 | Room Temp. | 2 to 3 | 3 | Max. Operating Temp.±2 | 30±3 | 4   | Room Temp. | 2 to 3 |
|                     |                                                                | Step                | Temperature (°C)                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Time (min.) |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | 1                   | Min. Operating Temp.±3                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30±3        |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | 2                   | Room Temp.                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2 to 3      |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | 3                   | Max. Operating Temp.±2                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30±3        |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| 4                   | Room Temp.                                                     | 2 to 3              |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| Capacitance Change  | Within ±7.5%                                                   |                     |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| D.F.                | 0.025 max.                                                     |                     |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| I.R.                | C≥0.01μF: More than 100MΩ • μF<br>C<0.01μF: More than 10,000MΩ |                     |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| Dielectric Strength | In accordance with item No.4                                   |                     |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
| 15                  | Humidity (Steady State)                                        | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                         | <p>Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ±<sub>2</sub>8 hrs.</p> <p>Remove and let sit for 24±2 hrs. at room condition*, then measure.</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ±<sub>1</sub>8 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | Capacitance Change  | Within ±15%                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | D.F.                | 0.05 max.                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | I.R.                | C≥0.01μF: More than 10MΩ • μF<br>C<0.01μF: More than 1,000MΩ                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |
|                     |                                                                | Dielectric Strength | In accordance with item No.4                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                  |             |   |                        |      |   |            |        |   |                        |      |     |            |        |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➤

## Specifications and Test Methods

Continued from the preceding page.

| No. | Item             |                     | Specifications                                                                                       | Test Method                                                                                                                                                                                                                                                                                                                                                       |
|-----|------------------|---------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16  | Life             | Appearance          | No marking defects                                                                                   | Apply DC350V for 1,000 $\pm$ 48 hrs. at maximum operating temperature $\pm$ 3°C. Remove and let sit for 24 $\pm$ 2 hrs. at room condition*, then measure.<br>The charge/discharge current is less than 50mA.<br><b>•Pretreatment</b><br>Apply test voltage for 60 $\pm$ 5 min. at test temperature.<br>Remove and let sit for 24 $\pm$ 2 hrs. at room condition*. |
|     |                  | Capacitance Change  | Within $\pm$ 15%                                                                                     |                                                                                                                                                                                                                                                                                                                                                                   |
|     |                  | D.F.                | 0.05 max.                                                                                            |                                                                                                                                                                                                                                                                                                                                                                   |
|     |                  | I.R.                | C $\geq$ 0.01 $\mu$ F: More than 10M $\Omega$ • $\mu$ F<br>C<0.01 $\mu$ F: More than 1,000M $\Omega$ |                                                                                                                                                                                                                                                                                                                                                                   |
|     |                  | Dielectric Strength | In accordance with item No.4                                                                         |                                                                                                                                                                                                                                                                                                                                                                   |
| 17  | Humidity Loading | Appearance          | No marking defects                                                                                   | Apply the rated voltage at 40 $\pm$ 2°C and relative humidity of 90 to 95% for 500 $\pm$ 24 hrs.<br>Remove and let sit for 24 $\pm$ 2 hrs. at room condition*, then measure.<br><b>•Pretreatment</b><br>Apply test voltage for 60 $\pm$ 5 min. at test temperature.<br>Remove and let sit for 24 $\pm$ 2 hrs. at room condition*.                                 |
|     |                  | Capacitance Change  | Within $\pm$ 15%                                                                                     |                                                                                                                                                                                                                                                                                                                                                                   |
|     |                  | D.F.                | 0.05 max.                                                                                            |                                                                                                                                                                                                                                                                                                                                                                   |
|     |                  | I.R.                | C $\geq$ 0.01 $\mu$ F: More than 10M $\Omega$ • $\mu$ F<br>C<0.01 $\mu$ F: More than 1,000M $\Omega$ |                                                                                                                                                                                                                                                                                                                                                                   |
|     |                  | Dielectric Strength | In accordance with item No.4                                                                         |                                                                                                                                                                                                                                                                                                                                                                   |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

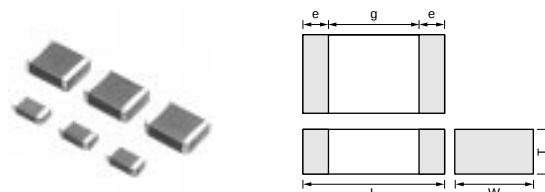
# Chip Monolithic Ceramic Capacitors



## AC250V (r.m.s.) Type (Which Meet Japanese Law)

### ■ Features

1. Chip monolithic ceramic capacitor for AC lines.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
3. Sn-plated external electrodes realizes good solderability.
4. Only for reflow soldering
5. Capacitance 0.01 to 0.1uF for connecting lines and 470 to 4700pF for connecting lines to earth.



| Part Number   | Dimensions (mm) |          |              |        |        |
|---------------|-----------------|----------|--------------|--------|--------|
|               | L               | W        | T            | e min. | g min. |
| <b>GA242Q</b> | 4.5 ±0.3        | 2.0 ±0.2 | 1.5 +0, -0.3 | 0.3    | 2.5    |
| <b>GA243D</b> | 4.5 ±0.4        | 3.2 ±0.3 | 2.0 +0, -0.3 |        |        |
| <b>GA243Q</b> |                 |          | 1.5 +0, -0.3 |        | 3.2    |
| <b>GA255D</b> | 5.7 ±0.4        | 5.0 ±0.4 | 2.0 +0, -0.3 |        |        |

### ■ Applications

Noise suppression filters for switching power supplies, telephones, facsimiles, modems.

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

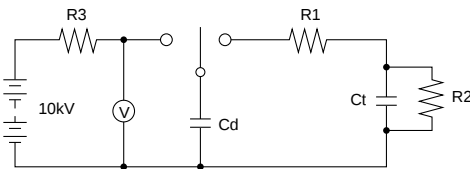
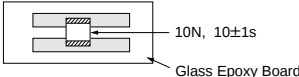
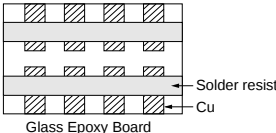
### ■ Reference Standard

GA2 series obtains no safety approval.

This series is based on the standards of the electrical appliance and material safety law of Japan (separated table 4).

| Part Number               | Rated Voltage (V) | TC Code (Standard) | Capacitance  | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---------------------------|-------------------|--------------------|--------------|---------------|--------------|------------------|-----------------------|------------------|
| <b>GA242QR7E2471MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 470pF ±20%   | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| <b>GA242QR7E2102MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 1000pF ±20%  | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| <b>GA243QR7E2222MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 2200pF ±20%  | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| <b>GA243QR7E2332MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 3300pF ±20%  | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| <b>GA243DR7E2472MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 4700pF ±20%  | 4.5           | 3.2          | 2.0              | 2.5                   | 0.3 min.         |
| <b>GA243QR7E2103MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 10000pF ±20% | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| <b>GA243QR7E2223MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 22000pF ±20% | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| <b>GA243DR7E2473MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 47000pF ±20% | 4.5           | 3.2          | 2.0              | 2.5                   | 0.3 min.         |
| <b>GA255DR7E2104MW01L</b> | AC250 (r.m.s.)    | X7R (EIA)          | 0.10μF ±20%  | 5.7           | 5.0          | 2.0              | 3.2                   | 0.3 min.         |

## Specifications and Test Methods

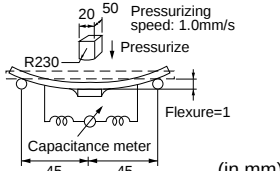
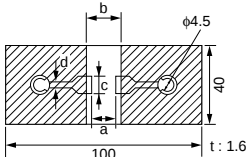
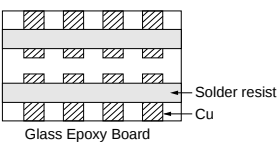
| No.                 | Item                                                         |             | Specifications                                                | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
|---------------------|--------------------------------------------------------------|-------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------|------------|-----------------|------------|------------------------|---|------|---|------------------------|---|------|
| 1                   | Operating Temperature Range                                  |             | −55 to +125℃                                                  | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 2                   | Appearance                                                   |             | No defects or abnormalities                                   | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 3                   | Dimensions                                                   |             | Within the specified dimensions                               | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 4                   | Dielectric Strength                                          |             | No defects or abnormalities                                   | No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. <table><tr><th>Nominal Capacitance</th><th>Test Voltage</th></tr><tr><td>C≥10,000pF</td><td>AC575V (r.m.s.)</td></tr><tr><td>C&lt;10,000pF</td><td>AC1500V (r.m.s.)</td></tr></table>                                                                                                                                                                                                                          | Nominal Capacitance | Test Voltage    | C≥10,000pF | AC575V (r.m.s.) | C<10,000pF | AC1500V (r.m.s.)       |   |      |   |                        |   |      |
| Nominal Capacitance | Test Voltage                                                 |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| C≥10,000pF          | AC575V (r.m.s.)                                              |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| C<10,000pF          | AC1500V (r.m.s.)                                             |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 5                   | Insulation Resistance (I.R.)                                 |             | More than 2,000MΩ                                             | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 6                   | Capacitance                                                  |             | Within the specified tolerance                                | The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.s.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 7                   | Dissipation Factor (D.F.)                                    |             | 0.025 max.                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 8                   | Capacitance Temperature Characteristics                      |             | Cap. Change Within ±15% (Temp. Range: −55 to +125℃)           | The capacitance measurement should be made at each step specified in Table. <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table> <p>•Pretreatment<br/>Perform a heat treatment at 150 ± 10℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>                                                                                                  | Step                | Temperature (℃) | 1          | 25±2            | 2          | Min. Operating Temp.±3 | 3 | 25±2 | 4 | Max. Operating Temp.±2 | 5 | 25±2 |
| Step                | Temperature (℃)                                              |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 1                   | 25±2                                                         |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 2                   | Min. Operating Temp.±3                                       |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 3                   | 25±2                                                         |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 4                   | Max. Operating Temp.±2                                       |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 5                   | 25±2                                                         |             |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 9                   | Discharge Test (Application: Nominal Capacitance C<10,000pF) | Appearance  | No defects or abnormalities                                   | As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified. <div><p>Ct: Capacitor under test    Cd: 0.001μF<br/>R1: 1,000Ω    R2: 100MΩ    R3: Surge resistance</p></div>                                                                                                                                                                                                                                                       |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 10                  | Adhesive Strength of Termination                             |             | No removal of the terminations or other defects should occur. | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.<br>Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. <div><p>Fig. 1</p></div>                                                                                                                                                              |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
| 11                  | Vibration Resistance                                         | Appearance  | No defects or abnormalities                                   | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). <div></div> |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
|                     |                                                              | Capacitance | Within the specified tolerance                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |
|                     |                                                              | D.F.        | 0.025 max.                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                 |            |                 |            |                        |   |      |   |                        |   |      |

\* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➤

## Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                         |                     | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                           | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|---------------------|------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-------------|---|------------------------|--------|---|--------------|--------|---------|------------------------|------|-----|------------|---------|-----|-----|-----|
| 12                  | Deflection                   |                     | No cracking or marking defects should occur.                                                                                                                                                                                                                                                                                                                                                                                                             | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.</p> <p>Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p>Fig. 3</p>                                                                                                                                                                                                                                                                                                                                                                                                   |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              |                     |  <table><tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="3">1.0</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table> <p>Fig. 2</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | L×W (mm)    | Dimension (mm)   |             |   |                        | a      | b | c            | d      | 4.5×2.0 | 3.5                    | 7.0  | 2.4 | 1.0        | 4.5×3.2 | 3.5 | 7.0 | 3.7 |
| L×W (mm)            | Dimension (mm)               |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     | a                            | b                   | c                                                                                                                                                                                                                                                                                                                                                                                                                                                        | d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 4.5×2.0             | 3.5                          | 7.0                 | 2.4                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 4.5×3.2             | 3.5                          | 7.0                 | 3.7                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 5.7×5.0             | 4.5                          | 8.0                 | 5.6                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 13                  | Solderability of Termination |                     | 75% of the terminations are to be soldered evenly and continuously.                                                                                                                                                                                                                                                                                                                                                                                      | <p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s</p> <p>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 14                  | Humidity Insulation          | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>The capacitor should be subjected to 40±2°C, relative humidity of 90 to 98% for 8 hrs., and then removed in room condition* for 16 hrs. until 5 cycles.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | Capacitance Change  | Within ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | D.F.                | 0.05 max.                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | I.R.                | More than 1,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | Dielectric Strength | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 15                  | Resistance to Soldering Heat | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Preheat the capacitor as table.</p> <p>Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.</p> <p>•Immersing speed: 25±2.5mm/s</p> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ± 18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p> <p>*Preheating</p> <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                                                                             | Step        | Temperature      | Time        | 1 | 100 to 120°C           | 1 min. | 2 | 170 to 200°C | 1 min. |         |                        |      |     |            |         |     |     |     |
|                     |                              | Step                | Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time        |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | 1                   | 100 to 120°C                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 min.      |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | 2                   | 170 to 200°C                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 min.      |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | Capacitance Change  | Within ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| D.F.                | 0.025 max.                   |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| I.R.                | More than 2,000MΩ            |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| Dielectric Strength | In accordance with item No.4 |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 16                  | Temperature Cycle            | Appearance          | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.</p> <p>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</p> <p>Let sit for 24±2 hrs. at room condition*, then measure.</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table> <p>•Pretreatment</p> <p>Perform a heat treatment at 150 ± 18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</p>  <p>Fig. 4</p> | Step        | Temperature (°C) | Time (min.) | 1 | Min. Operating Temp.±3 | 30±3   | 2 | Room Temp.   | 2 to 3 | 3       | Max. Operating Temp.±2 | 30±3 | 4   | Room Temp. | 2 to 3  |     |     |     |
|                     |                              | Step                | Temperature (°C)                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time (min.) |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | 1                   | Min. Operating Temp.±3                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30±3        |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | 2                   | Room Temp.                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2 to 3      |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
|                     |                              | 3                   | Max. Operating Temp.±2                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30±3        |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| 4                   | Room Temp.                   | 2 to 3              |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| Capacitance Change  | Within ±15%                  |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| D.F.                | 0.05 max.                    |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| I.R.                | More than 2,000MΩ            |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |
| Dielectric Strength | In accordance with item No.4 |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                  |             |   |                        |        |   |              |        |         |                        |      |     |            |         |     |     |     |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

## Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                         |                     | Specifications               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |           |              |            |                           |                 |            |                           |                   |
|---------------------|------------------------------|---------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------|--------------|------------|---------------------------|-----------------|------------|---------------------------|-------------------|
| 17                  | Humidity<br>(Steady State)   | Appearance          | No marking defects           | Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500 <sup>±24</sup> hrs.<br>Remove and let sit for 24±2 hrs. at room condition*, then measure.<br>•Pretreatment<br>Perform a heat treatment at 150 <sup>±18</sup> ℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.                                                                                                                                                                                                                                                                                                                                                                                           |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | Capacitance Change  | Within ±15%                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | D.F.                | 0.05 max.                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | I.R.                | More than 1,000MΩ            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | Dielectric Strength | In accordance with item No.4 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
| 18                  | Life                         | Appearance          | No marking defects           | Apply voltage and time as Table at maximum operating temperature ±3℃. Remove and let sit for 24±2 hrs. at room condition*, then measure. The charge / discharge current is less than 50mA. <table><tr><th>Nominal Capacitance</th><th>Test Time</th><th>Test Voltage</th></tr><tr><td>C≥10,000pF</td><td>1,000<sup>±48</sup> hrs.</td><td>AC300V (r.m.s.)</td></tr><tr><td>C&lt;10,000pF</td><td>1,500<sup>±48</sup> hrs.</td><td>AC500V (r.m.s.) *</td></tr></table> * Except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.<br><br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at room condition*. | Nominal Capacitance | Test Time | Test Voltage | C≥10,000pF | 1,000 <sup>±48</sup> hrs. | AC300V (r.m.s.) | C<10,000pF | 1,500 <sup>±48</sup> hrs. | AC500V (r.m.s.) * |
|                     |                              | Nominal Capacitance | Test Time                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Test Voltage        |           |              |            |                           |                 |            |                           |                   |
|                     |                              | C≥10,000pF          | 1,000 <sup>±48</sup> hrs.    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AC300V (r.m.s.)     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | C<10,000pF          | 1,500 <sup>±48</sup> hrs.    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AC500V (r.m.s.) *   |           |              |            |                           |                 |            |                           |                   |
|                     |                              | Capacitance Change  | Within ±20%                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
| D.F.                | 0.05 max.                    |                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
| I.R.                | More than 1,000MΩ            |                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
| Dielectric Strength | In accordance with item No.4 |                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
| 19                  | Humidity<br>Loading          | Appearance          | No marking defects           | Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 <sup>±24</sup> hrs.<br>Remove and let sit for 24±2 hrs. at room condition*, then measure.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at room condition*.                                                                                                                                                                                                                                                                                                                                                                                             |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | Capacitance Change  | Within ±15%                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | D.F.                | 0.05 max.                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | I.R.                | More than 1,000MΩ            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |
|                     |                              | Dielectric Strength | In accordance with item No.4 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |           |              |            |                           |                 |            |                           |                   |

\* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

**myRata**

|       | Standard No.                                   | Class        | Rated Voltage      |
|-------|------------------------------------------------|--------------|--------------------|
| UL    | UL1414                                         | Line By-pass | AC250V<br>(r.m.s.) |
| VDE   | IEC 60384-14<br>EN 60384-14                    | X1, Y2       |                    |
| BSI   | EN 60065 (14.2)<br>IEC 60384-14<br>EN 60384-14 |              |                    |
| SEMKO | IEC 60384-14<br>EN 60384-14                    |              |                    |
| ESTI  | EN 60065<br>IEC 60384-14                       |              |                    |

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GA355DR7GC101KY02L | AC250 (r.m.s.)    | X7R (EIA)          | 100 ±10%         | 5.7           | 5.0          | 2.0              | 4.0                   | 0.3 min.         |
| GA355DR7GC151KY02L | AC250 (r.m.s.)    | X7R (EIA)          | 150 ±10%         | 5.7           | 5.0          | 2.0              | 4.0                   | 0.3 min.         |
| GA355DR7GC221KY02L | AC250 (r.m.s.)    | X7R (EIA)          | 220 ±10%         | 5.7           | 5.0          | 2.0              | 4.0                   | 0.3 min.         |
| GA355DR7GC331KY02L | AC250 (r.m.s.)    | X7R (EIA)          | 330 ±10%         | 5.7           | 5.0          | 2.0              | 4.0                   | 0.3 min.         |

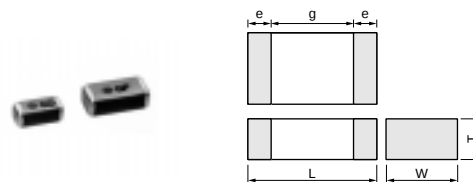
# Chip Monolithic Ceramic Capacitors

**muRata**

## Safety Standard Certified Type GD (IEC60384-14 Class Y3)

### ■ Features

1. Available for equipment based on IEC/EN60950 and UL1950
2. The type GD can be used as a Y3-class capacitor.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
4. +125 degree C guaranteed
5. Only for reflow soldering
6. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.



| Part Number | Dimensions (mm) |          |              |        |        |
|-------------|-----------------|----------|--------------|--------|--------|
|             | L               | W        | T            | e min. | g min. |
| GA342A      | 4.5 ±0.3        | 2.0 ±0.2 | 1.0 +0, -0.3 | 0.3    | 2.5    |
| GA342D      |                 |          | 2.0 ±0.3     |        |        |
| GA342Q      |                 |          | 1.5 +0, -0.3 |        |        |
| GA343D      | 4.5 ±0.4        | 3.2 ±0.3 | 2.0 +0, -0.3 |        |        |
| GA343Q      |                 |          | 1.5 +0, -0.3 |        |        |

### ■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers
2. Ideal for use on line filters for information equipment

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

### ■ Standard Certification

|       | Standard No.                | Class | Rated Voltage  |
|-------|-----------------------------|-------|----------------|
| UL    | UL 60950-1                  | Y3    | AC250V(r.m.s.) |
| SEMKO | IEC 60384-14<br>EN 60384-14 |       |                |

#### Applications

| Size                | Switching power supplies | Communication network devices such as a modem |
|---------------------|--------------------------|-----------------------------------------------|
| 4.5×3.2mm and under | —                        | ◎                                             |

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GA342D1XGD100JY02L | AC250 (r.m.s.)    | SL (JIS)           | 10 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGD120JY02L | AC250 (r.m.s.)    | SL (JIS)           | 12 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGD150JY02L | AC250 (r.m.s.)    | SL (JIS)           | 15 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGD180JY02L | AC250 (r.m.s.)    | SL (JIS)           | 18 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGD220JY02L | AC250 (r.m.s.)    | SL (JIS)           | 22 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD270JW31L | AC250 (r.m.s.)    | SL (JIS)           | 27 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD330JW31L | AC250 (r.m.s.)    | SL (JIS)           | 33 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD390JW31L | AC250 (r.m.s.)    | SL (JIS)           | 39 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD470JW31L | AC250 (r.m.s.)    | SL (JIS)           | 47 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD560JW31L | AC250 (r.m.s.)    | SL (JIS)           | 56 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD680JW31L | AC250 (r.m.s.)    | SL (JIS)           | 68 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGD820JW31L | AC250 (r.m.s.)    | SL (JIS)           | 82 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342QR7GD101KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 100 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD151KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 150 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD221KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 220 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD331KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 330 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD471KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 470 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD681KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 680 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD102KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 1000 ±10%        | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GD152KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 1500 ±10%        | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA343QR7GD182KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 1800 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GA343QR7GD222KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 2200 ±10%        | 4.5           | 3.2          | 1.5              | 2.5                   | 0.3 min.         |
| GA343DR7GD472KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 4700 ±10%        | 4.5           | 3.2          | 2.0              | 2.5                   | 0.3 min.         |

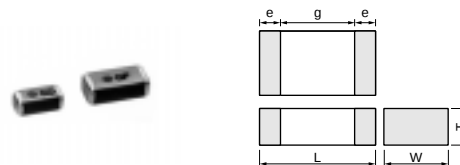
# Chip Monolithic Ceramic Capacitors

**muRata**

## Safety Standard Certified Type GF (IEC60384-14 Class Y2, X1/Y2)

### ■ Features

1. Available for equipment based on IEC/EN60950 and UL1950. Besides, the GA352/355 types are available for equipment based on IEC/EN60065, UL1492, and UL6500
2. The type GF can be used as a Y2-class capacitor.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
4. +125 degree C guaranteed
5. Only for reflow soldering
6. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.



| Part Number | Dimensions (mm) |          |              |        |        |
|-------------|-----------------|----------|--------------|--------|--------|
|             | L               | W        | T            | e min. | g min. |
| GA342A      | 4.5 ±0.3        | 2.0 ±0.2 | 1.0 +0, -0.3 | 0.3    | 2.5    |
| GA342D      |                 |          | 2.0 ±0.2*    |        |        |
| GA342Q      |                 |          | 1.5 +0, -0.3 |        |        |
| GA352Q      | 5.7 ±0.4        | 2.8 ±0.3 | 1.5 +0, -0.3 | 0.3    | 4.0    |
| GA355D      |                 |          | 2.0 +0, -0.3 |        |        |
| GA355Q      |                 |          | 1.5 +0, -0.3 |        |        |

\* GA342D1X : 2.0±0.3

### ■ Standard Certification

|       | Standard No. | Class  | Status of Certification |                           | Rated Voltage      |
|-------|--------------|--------|-------------------------|---------------------------|--------------------|
|       |              |        | Size : 4.5×2.0mm        | Size : 5.7×2.8mm and over |                    |
| UL    | UL1414       | X1, Y2 | —                       | ⊙                         | AC250V<br>(r.m.s.) |
|       | UL 60950-1   | —      | ⊙                       | —                         |                    |
| VDE   | IEC 60384-14 | X1, Y2 | —                       | ⊙                         | (r.m.s.)           |
| SEMKO | EN 60384-14  | Y2     | ⊙                       | ⊙                         |                    |

#### Applications

| Size               | Switching power supplies | Communication network devices such as a modem |
|--------------------|--------------------------|-----------------------------------------------|
| 4.5×2.0mm          | —                        | ⊙                                             |
| 5.7×2.8mm and over | ⊙                        | ⊙                                             |

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GA342D1XGF100JY02L | AC250 (r.m.s.)    | SL (JIS)           | 10 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGF120JY02L | AC250 (r.m.s.)    | SL (JIS)           | 12 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGF150JY02L | AC250 (r.m.s.)    | SL (JIS)           | 15 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGF180JY02L | AC250 (r.m.s.)    | SL (JIS)           | 18 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342D1XGF220JY02L | AC250 (r.m.s.)    | SL (JIS)           | 22 ±5%           | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF270JW31L | AC250 (r.m.s.)    | SL (JIS)           | 27 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF330JW31L | AC250 (r.m.s.)    | SL (JIS)           | 33 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF390JW31L | AC250 (r.m.s.)    | SL (JIS)           | 39 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF470JW31L | AC250 (r.m.s.)    | SL (JIS)           | 47 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF560JW31L | AC250 (r.m.s.)    | SL (JIS)           | 56 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF680JW31L | AC250 (r.m.s.)    | SL (JIS)           | 68 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342A1XGF820JW31L | AC250 (r.m.s.)    | SL (JIS)           | 82 ±5%           | 4.5           | 2.0          | 1.0              | 2.5                   | 0.3 min.         |
| GA342QR7GF101KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 100 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342QR7GF151KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 150 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA342DR7GF221KW02L | AC250 (r.m.s.)    | X7R (EIA)          | 220 ±10%         | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342DR7GF331KW02L | AC250 (r.m.s.)    | X7R (EIA)          | 330 ±10%         | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA342QR7GF471KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 470 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |
| GA352QR7GF471KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 470 ±10%         | 5.7           | 2.8          | 1.5              | 4.0                   | 0.3 min.         |
| GA342QR7GF681KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 680 ±10%         | 4.5           | 2.0          | 1.5              | 2.5                   | 0.3 min.         |

Continued on the following page.

**muRata**

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GA352QR7GF681KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 680 ±10%         | 5.7           | 2.8          | 1.5              | 4.0                   | 0.3 min.         |
| GA342DR7GF102KW02L | AC250 (r.m.s.)    | X7R (EIA)          | 1000 ±10%        | 4.5           | 2.0          | 2.0              | 2.5                   | 0.3 min.         |
| GA352QR7GF102KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 1000 ±10%        | 5.7           | 2.8          | 1.5              | 4.0                   | 0.3 min.         |
| GA352QR7GF152KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 1500 ±10%        | 5.7           | 2.8          | 1.5              | 4.0                   | 0.3 min.         |
| GA355QR7GF182KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 1800 ±10%        | 5.7           | 5.0          | 1.5              | 4.0                   | 0.3 min.         |
| GA355QR7GF222KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 2200 ±10%        | 5.7           | 5.0          | 1.5              | 4.0                   | 0.3 min.         |
| GA355QR7GF332KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 3300 ±10%        | 5.7           | 5.0          | 1.5              | 4.0                   | 0.3 min.         |
| GA355DR7GF472KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 4700 ±10%        | 5.7           | 5.0          | 2.0              | 4.0                   | 0.3 min.         |

# Chip Monolithic Ceramic Capacitors



## Safety Standard Certified Type GB (IEC60384-14 Class X2)

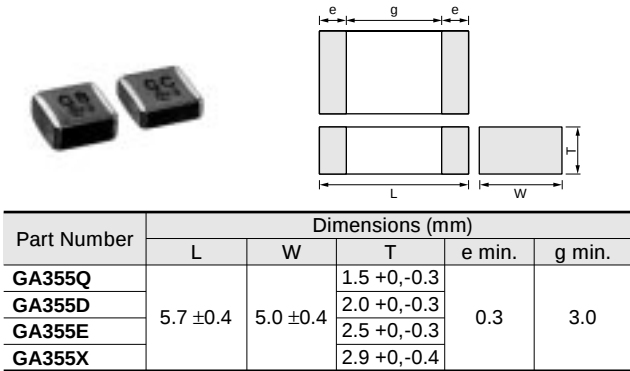
### ■ Features

1. The type GB can be used as an X2-class capacitor.
2. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC lines
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
4. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
5. +125 degree C guaranteed
6. Only for reflow soldering

### ■ Applications

Ideal for use as X capacitor for various switching power supplies

Do not use these products in any Automotive Power train or Safety equipment including Battery charger for Electric Vehicles and Plug-in Hybrid. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as Power train and Safety equipment.

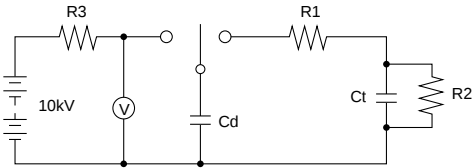
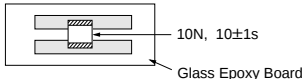


### ■ Standard Certification

|       | Standard No.                | Class | Rated Voltage      |
|-------|-----------------------------|-------|--------------------|
| VDE   | IEC 60384-14<br>EN 60384-14 | X2    | AC250V<br>(r.m.s.) |
| SEMKO |                             |       |                    |
| ESTI  |                             |       |                    |

| Part Number        | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GA355QR7GB103KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 10000 ±10%       | 5.7           | 5.0          | 1.5              | 3.0                   | 0.3 min.         |
| GA355QR7GB153KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 15000 ±10%       | 5.7           | 5.0          | 1.5              | 3.0                   | 0.3 min.         |
| GA355DR7GB223KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 22000 ±10%       | 5.7           | 5.0          | 2.0              | 3.0                   | 0.3 min.         |
| GA355ER7GB333KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 33000 ±10%       | 5.7           | 5.0          | 2.5              | 3.0                   | 0.3 min.         |
| GA355ER7GB473KW01L | AC250 (r.m.s.)    | X7R (EIA)          | 47000 ±10%       | 5.7           | 5.0          | 2.5              | 3.0                   | 0.3 min.         |
| GA355XR7GB563KW06L | AC250 (r.m.s.)    | X7R (EIA)          | 56000 ±10%       | 5.7           | 5.0          | 2.9              | 3.0                   | 0.3 min.         |

## GA3 Series Specifications and Test Methods

| No.           | Item                                       | Specifications                                                                                                                                                                                                                                                                                                                            | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
|---------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|------------|-------------------------|-----------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------|---|--------------------------|---|------------------------|---|--------------------------|---|------------------------|---|--------------------------|
| 1             | Operating Temperature Range                | −55 to +125℃                                                                                                                                                                                                                                                                                                                              | —                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 2             | Appearance                                 | No defects or abnormalities                                                                                                                                                                                                                                                                                                               | Visual inspection                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 3             | Dimensions                                 | Within the specified dimensions                                                                                                                                                                                                                                                                                                           | Using calipers                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 4             | Dielectric Strength                        | No defects or abnormalities                                                                                                                                                                                                                                                                                                               | No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. <table><tr><th></th><th>Test Voltage</th></tr><tr><td>Type GB</td><td>DC1075V</td></tr><tr><td>Type GC/GD/GF</td><td>AC1500V (r.m.s.)</td></tr></table>                                                                                                                                   |                                                                                                                                                                                                                                                                                                                       | Test Voltage  | Type GB     | DC1075V    | Type GC/GD/GF           | AC1500V (r.m.s.)                        |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
|               | Test Voltage                               |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| Type GB       | DC1075V                                    |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| Type GC/GD/GF | AC1500V (r.m.s.)                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 5             | Pulse Voltage<br>(Application: Type GD/GF) | No self healing breakdowns or flash-overs have taken place in the capacitor.                                                                                                                                                                                                                                                              | 10 impulse of alternating polarity is subjected.<br>(5 impulse for each polarity)<br>The interval between impulse is 60 sec.<br>Applied Voltage: 2.5kV zero to peak                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 6             | Insulation Resistance (I.R.)               | More than 6,000MΩ                                                                                                                                                                                                                                                                                                                         | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 7             | Capacitance                                | Within the specified tolerance                                                                                                                                                                                                                                                                                                            | The capacitance/Q/D.F. should be measured at a frequency of 1±0.2kHz (SL char.: 1±0.2MHz) and a voltage of AC1±0.2V (r.m.s.)                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 8             | Dissipation Factor (D.F.)<br>Q             | <table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≤0.025</td></tr><tr><td>SL</td><td>Q≥400+20C*2 (C&lt;30pF)<br/>Q≥1000 (C≥30pF)</td></tr></table>                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Char.                                                                                                                                                                                                                                                                                                                 | Specification | X7R         | D.F.≤0.025 | SL                      | Q≥400+20C*2 (C<30pF)<br>Q≥1000 (C≥30pF) |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| Char.         | Specification                              |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| X7R           | D.F.≤0.025                                 |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| SL            | Q≥400+20C*2 (C<30pF)<br>Q≥1000 (C≥30pF)    |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 9             | Capacitance Temperature Characteristics    | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table> Temperature characteristic guarantee is −55 to +125℃ <table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to −1000ppm/℃</td></tr></table> Temperature characteristic guarantee is +20 to +85℃ | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Capacitance Change                                                                                                                                                                                                                                                                                                    | X7R           | Within ±15% | Char.      | Temperature Coefficient | SL                                      | +350 to −1000ppm/℃ | The capacitance measurement should be made at each step specified in Table. <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2 (20±2 for SL char.)</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2 (20±2 for SL char.)</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2 (20±2 for SL char.)</td></tr></table> <p>SL char. :<br/>The capacitance should be measured at even 85℃ between step 3 and step 4.<br/>•Pretreatment for X7R char.<br/>Perform a heat treatment at 150 ± 18℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.</p> | Step | Temperature (℃) | 1 | 25±2 (20±2 for SL char.) | 2 | Min. Operating Temp.±3 | 3 | 25±2 (20±2 for SL char.) | 4 | Max. Operating Temp.±2 | 5 | 25±2 (20±2 for SL char.) |
| Char.         | Capacitance Change                         |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| X7R           | Within ±15%                                |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| Char.         | Temperature Coefficient                    |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| SL            | +350 to −1000ppm/℃                         |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| Step          | Temperature (℃)                            |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 1             | 25±2 (20±2 for SL char.)                   |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 2             | Min. Operating Temp.±3                     |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 3             | 25±2 (20±2 for SL char.)                   |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 4             | Max. Operating Temp.±2                     |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 5             | 25±2 (20±2 for SL char.)                   |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 10            | Discharge Test<br>(Application: Type GC)   | Appearance                                                                                                                                                                                                                                                                                                                                | No defects or abnormalities                                                                                                                                                                                                                                                                                                                                                                                                                               | As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified. <div><p>Ct: Capacitor under test   Cd: 0.001μF<br/>R1: 1,000Ω   R2: 100MΩ   R3: Surge resistance</p></div> |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
|               |                                            | I.R.                                                                                                                                                                                                                                                                                                                                      | More than 1,000MΩ                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
|               |                                            | Dielectric Strength                                                                                                                                                                                                                                                                                                                       | In accordance with item No.4                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |
| 11            | Adhesive Strength of Termination           | No removal of the terminations or other defect should occur.                                                                                                                                                                                                                                                                              | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.<br>Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. <div><p>10N, 10±1s<br/>Glass Epoxy Board</p></div> <p>Fig. 1</p> |                                                                                                                                                                                                                                                                                                                       |               |             |            |                         |                                         |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                 |   |                          |   |                        |   |                          |   |                        |   |                          |

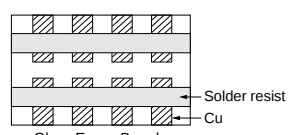
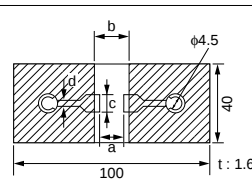
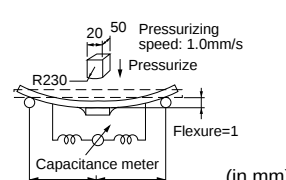
\*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page. 

## GA3 Series Specifications and Test Methods

Continued from the preceding page.

| No.                                                                 | Item                                                                                                                                                                                 |                                              | Specifications                                                                                                                                                                          | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|-----------------------------------------------|-------------|--------------|---------------------------------------------------|---|--------------|--------|---|---------|-----|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|
| 12                                                                  | Vibration Resistance                                                                                                                                                                 | Appearance                                   | No defects or abnormalities                                                                                                                                                             | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).<br>                                                                                                                                                                                                                                                                                                                                                     |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|                                                                     |                                                                                                                                                                                      | Capacitance                                  | Within the specified tolerance                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|                                                                     |                                                                                                                                                                                      | D.F.<br>Q                                    | <table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F. ≤0.025</td></tr><tr><td>SL</td><td>Q ≥ 400 + 20C*2 (C &lt; 30pF)<br/>Q ≥ 1000 (C ≥ 30pF)</td></tr></table> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Char.       | Specification  | X7R                                           | D.F. ≤0.025 | SL           | Q ≥ 400 + 20C*2 (C < 30pF)<br>Q ≥ 1000 (C ≥ 30pF) |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| Char.                                                               | Specification                                                                                                                                                                        |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| X7R                                                                 | D.F. ≤0.025                                                                                                                                                                          |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| SL                                                                  | Q ≥ 400 + 20C*2 (C < 30pF)<br>Q ≥ 1000 (C ≥ 30pF)                                                                                                                                    |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 13                                                                  | Deflection                                                                                                                                                                           | No cracking or marking defects should occur. |                                                                                                                                                                                         | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.<br>Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br> <table><tr><th>L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="4">1.0</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7×2.8</td><td>4.5</td><td>8.0</td><td>3.2</td></tr><tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table><br>Fig. 2<br><br>Fig. 3 | L×W (mm)    | Dimension (mm) |                                               |             |              |                                                   | a | b            | c      | d | 4.5×2.0 | 3.5 | 7.0 | 2.4 | 1.0 | 4.5×3.2 | 3.5 | 7.0 | 3.7 | 5.7×2.8 | 4.5 | 8.0 | 3.2 | 5.7×5.0 | 4.5 | 8.0 | 5.6 |
|                                                                     |                                                                                                                                                                                      | L×W (mm)                                     | Dimension (mm)                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|                                                                     |                                                                                                                                                                                      |                                              | a                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | b           | c              | d                                             |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 4.5×2.0                                                             | 3.5                                                                                                                                                                                  | 7.0                                          | 2.4                                                                                                                                                                                     | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 4.5×3.2                                                             | 3.5                                                                                                                                                                                  | 7.0                                          | 3.7                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 5.7×2.8                                                             | 4.5                                                                                                                                                                                  | 8.0                                          | 3.2                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 5.7×5.0                                                             | 4.5                                                                                                                                                                                  | 8.0                                          | 5.6                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 75% of the terminations are to be soldered evenly and continuously. |                                                                                                                                                                                      |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 14                                                                  | Solderability of Termination                                                                                                                                                         |                                              |                                                                                                                                                                                         | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Immerse in solder solution for 2±0.5 sec.<br>Immersing speed: 25±2.5mm/s<br>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| 15                                                                  | Resistance to Soldering Heat                                                                                                                                                         | Appearance                                   | No marking defects                                                                                                                                                                      | Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition*1 for 24±2 hrs., then measure.<br>•Immersing speed: 25±2.5mm/s<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 ± 18 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.<br><br>*Preheating<br><table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200°C</td><td>1 min.</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                        | Step        | Temperature    | Time                                          | 1           | 100 to 120°C | 1 min.                                            | 2 | 170 to 200°C | 1 min. |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|                                                                     |                                                                                                                                                                                      | Step                                         | Temperature                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Time        |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|                                                                     |                                                                                                                                                                                      | 1                                            | 100 to 120°C                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 min.      |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
|                                                                     |                                                                                                                                                                                      | 2                                            | 170 to 200°C                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 min.      |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| Capacitance Change                                                  | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±10%</td></tr><tr><td>SL</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr></table> | Char.                                        | Capacitance Change                                                                                                                                                                      | X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Within ±10% | SL             | Within ±2.5% or ±0.25pF (Whichever is larger) |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| Char.                                                               | Capacitance Change                                                                                                                                                                   |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| X7R                                                                 | Within ±10%                                                                                                                                                                          |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| SL                                                                  | Within ±2.5% or ±0.25pF (Whichever is larger)                                                                                                                                        |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| I.R.                                                                | More than 1,000MΩ                                                                                                                                                                    |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |
| Dielectric Strength                                                 | In accordance with item No.4                                                                                                                                                         |                                              |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                |                                               |             |              |                                                   |   |              |        |   |         |     |     |     |     |         |     |     |     |         |     |     |     |         |     |     |     |

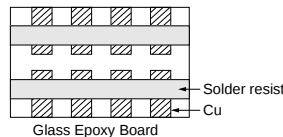
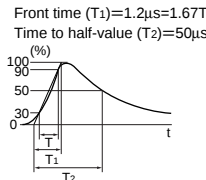
\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page. ➤

## GA3 Series Specifications and Test Methods

Continued from the preceding page.

| No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Item                                                                                                                                                                            | Specifications     | Test Method                                                                                                                                                                          |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|----------------------------------------------------------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------|----|------------|--------|---|------------------------|------|---|------------|--------|
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Temperature Cycle                                                                                                                                                               | Appearance         | No marking defects                                                                                                                                                                   |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr></table> | Char.              | Capacitance Change | X7R         | Within ±15%                                                                                              | SL                     | Within ±2.5% or ±0.25pF (Whichever is larger)                                                          |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 |                    | Char.                                                                                                                                                                                | Capacitance Change |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | X7R                | Within ±15%                                                                                                                                                                          |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | SL                 | Within ±2.5% or ±0.25pF (Whichever is larger)                                                                                                                                        |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| D.F. Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F. ≤0.05</td></tr><tr><td>SL</td><td>Q ≥400+20C*2 (C&lt;30pF)<br/>Q ≥1000 (C ≥30pF)</td></tr></table> | Char.              | Specification                                                                                                                                                                        | X7R                | D.F. ≤0.05         | SL          | Q ≥400+20C*2 (C<30pF)<br>Q ≥1000 (C ≥30pF)                                                               |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Char.                                                                                                                                                                           | Specification      |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D.F. ≤0.05                                                                                                                                                                      |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| SL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Q ≥400+20C*2 (C<30pF)<br>Q ≥1000 (C ≥30pF)                                                                                                                                      |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| I.R.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | More than 3,000MΩ                                                                                                                                                               |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| Dielectric Strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | In accordance with item No.4                                                                                                                                                    |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| <div><p>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.</p><p>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</p><p>Let sit for 24±2 hrs. at room condition*1, then measure.</p><table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table><p>•Pretreatment for X7R char.</p><p>Perform a heat treatment at 150 ±1.8 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.</p><div><p>Fig. 4</p></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                 |                    |                                                                                                                                                                                      | Step               | Temperature (°C)   | Time (min.) | 1                                                                                                        | Min. Operating Temp.±3 | 30±3                                                                                                   | 2  | Room Temp. | 2 to 3 | 3 | Max. Operating Temp.±2 | 30±3 | 4 | Room Temp. | 2 to 3 |
| Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Temperature (°C)                                                                                                                                                                | Time (min.)        |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Min. Operating Temp.±3                                                                                                                                                          | 30±3               |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Room Temp.                                                                                                                                                                      | 2 to 3             |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Max. Operating Temp.±2                                                                                                                                                          | 30±3               |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Room Temp.                                                                                                                                                                      | 2 to 3             |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Humidity (Steady State)                                                                                                                                                         | Appearance         | No marking defects                                                                                                                                                                   |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±5.0% or ±0.5pF (Whichever is larger)</td></tr></table>  | Char.              | Capacitance Change | X7R         | Within ±15%                                                                                              | SL                     | Within ±5.0% or ±0.5pF (Whichever is larger)                                                           |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 |                    | Char.                                                                                                                                                                                | Capacitance Change |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | X7R                | Within ±15%                                                                                                                                                                          |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | SL                 | Within ±5.0% or ±0.5pF (Whichever is larger)                                                                                                                                         |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| D.F. Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F. ≤0.05</td></tr><tr><td>SL</td><td>Q ≥275+5/2C*2 (C&lt;30pF)<br/>Q ≥350 (C ≥30pF)</td></tr></table> | Char.              | Specification                                                                                                                                                                        | X7R                | D.F. ≤0.05         | SL          | Q ≥275+5/2C*2 (C<30pF)<br>Q ≥350 (C ≥30pF)                                                               |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Char.                                                                                                                                                                           | Specification      |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D.F. ≤0.05                                                                                                                                                                      |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| SL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Q ≥275+5/2C*2 (C<30pF)<br>Q ≥350 (C ≥30pF)                                                                                                                                      |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| I.R.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | More than 3,000MΩ                                                                                                                                                               |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| Dielectric Strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | In accordance with item No.4                                                                                                                                                    |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| <div><p>Before this test, the test shown in the following is performed.</p><p>·Item 11 Adhesive Strength of Termination (applied force is 5N)</p><p>·Item 13 Deflection</p><p>Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ±2 hrs.</p><p>Remove and let sit for 24±2 hrs. at room condition*1, then measure.</p><p>•Pretreatment for X7R char.</p><p>Perform a heat treatment at 150 ±1.8 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.</p></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                 |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Life                                                                                                                                                                            | Appearance         | No marking defects                                                                                                                                                                   |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ±3.0% or ±0.3pF (Whichever is larger)</td></tr></table>  | Char.              | Capacitance Change | X7R         | Within ±20%                                                                                              | SL                     | Within ±3.0% or ±0.3pF (Whichever is larger)                                                           |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 |                    | Char.                                                                                                                                                                                | Capacitance Change |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | X7R                | Within ±20%                                                                                                                                                                          |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                 | SL                 | Within ±3.0% or ±0.3pF (Whichever is larger)                                                                                                                                         |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| D.F. Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F. ≤0.05</td></tr><tr><td>SL</td><td>Q ≥275+5/2C*2 (C&lt;30pF)<br/>Q ≥350 (C ≥30pF)</td></tr></table> | Char.              | Specification                                                                                                                                                                        | X7R                | D.F. ≤0.05         | SL          | Q ≥275+5/2C*2 (C<30pF)<br>Q ≥350 (C ≥30pF)                                                               |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Char.                                                                                                                                                                           | Specification      |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D.F. ≤0.05                                                                                                                                                                      |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| SL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Q ≥275+5/2C*2 (C<30pF)<br>Q ≥350 (C ≥30pF)                                                                                                                                      |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| I.R.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | More than 3,000MΩ                                                                                                                                                               |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| Dielectric Strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | In accordance with item No.4                                                                                                                                                    |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| <div><p>Before this test, the test shown in the following is performed.</p><p>·Item 11 Adhesive Strength of Termination (apply force is 5N)</p><p>·Item 13 Deflection</p><p>Impulse Voltage</p><p>Each individual capacitor should be subjected to a 2.5kV (Type GC/GF: 5kV) Impulse (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.</p><div><p>Front time (T1)=1.2μs=1.67T<br/>Time to half-value (T2)=50μs</p></div><p>Apply voltage as Table for 1,000 hrs. at 125 ±2 °C, relative humidity 50% max.</p><table><tr><th>Type</th><th>Applied Voltage</th></tr><tr><td>GB</td><td>AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr><tr><td>GC</td><td rowspan="3">AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr><tr><td>GD</td></tr><tr><td>GF</td></tr></table><p>Let sit for 24±2 hrs. at room condition*1, then measure.</p><p>•Pretreatment for X7R char.</p><p>Perform a heat treatment at 150 ±1.8 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.</p></div> |                                                                                                                                                                                 |                    |                                                                                                                                                                                      | Type               | Applied Voltage    | GB          | AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec. | GC                     | AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec. | GD | GF         |        |   |                        |      |   |            |        |
| Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Applied Voltage                                                                                                                                                                 |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| GB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.                                                                        |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| GC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.                                                                          |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| GD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                 |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |
| GF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                 |                    |                                                                                                                                                                                      |                    |                    |             |                                                                                                          |                        |                                                                                                        |    |            |        |   |                        |      |   |            |        |

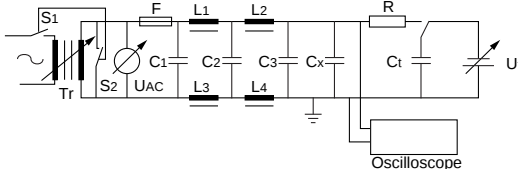
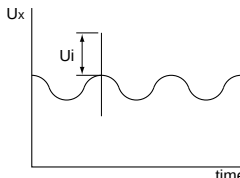
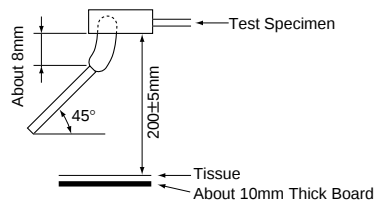
\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

## GA3 Series Specifications and Test Methods

Continued from the preceding page.

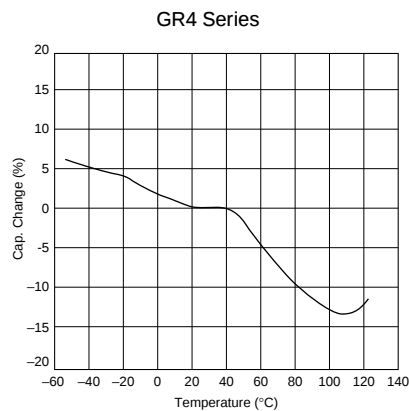
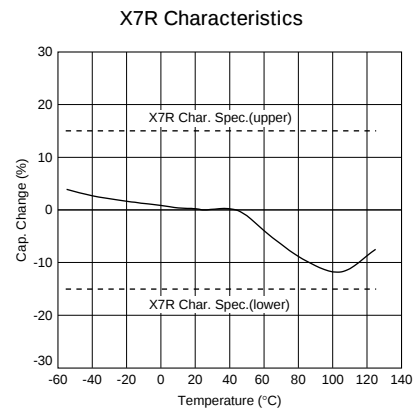
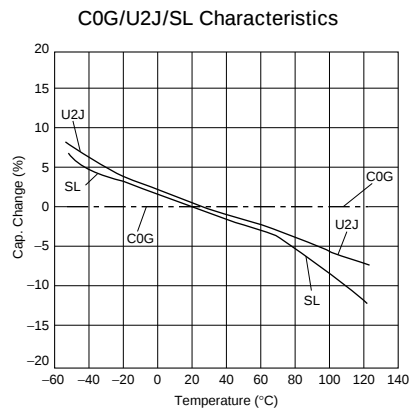
| No.                 | Item                                                                                                                                                                            |                                                                                           | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                    |                                            |             |     |                                              |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|--------------------------------------------|-------------|-----|----------------------------------------------|
| 19                  | Humidity Loading                                                                                                                                                                | Appearance                                                                                | No marking defects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>Before this test, the test shown in the following is performed.</p> <p>·Item 11 Adhesive Strength of Termination (apply force is 5N)</p> <p>·Item 13 Deflection</p> <p>Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 ±24 hrs. Remove and let sit for 24±2 hrs. at room condition*1, then measure.</p> <p>•Pretreatment for X7R char.<br/>Perform a heat treatment at 150 ±18℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.</p> |            |                    |                                            |             |     |                                              |
|                     |                                                                                                                                                                                 | Capacitance Change                                                                        | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±5.0% or ±0.5pF (Whichever is larger)</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Char.      | Capacitance Change | X7R                                        | Within ±15% | SL  | Within ±5.0% or ±0.5pF (Whichever is larger) |
|                     |                                                                                                                                                                                 | Char.                                                                                     | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
|                     |                                                                                                                                                                                 | X7R                                                                                       | Within ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
|                     |                                                                                                                                                                                 | SL                                                                                        | Within ±5.0% or ±0.5pF (Whichever is larger)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| D.F.<br>Q           | <table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F. ≤0.05</td></tr><tr><td>SL</td><td>Q ≥275+5/2C*2 (C&lt;30pF)<br/>Q ≥350 (C ≥30pF)</td></tr></table> | Char.                                                                                     | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | D.F. ≤0.05 | SL                 | Q ≥275+5/2C*2 (C<30pF)<br>Q ≥350 (C ≥30pF) |             |     |                                              |
| Char.               | Specification                                                                                                                                                                   |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| X7R                 | D.F. ≤0.05                                                                                                                                                                      |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| SL                  | Q ≥275+5/2C*2 (C<30pF)<br>Q ≥350 (C ≥30pF)                                                                                                                                      |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| I.R.                | More than 3,000MΩ                                                                                                                                                               |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| Dielectric Strength | In accordance with item No.4                                                                                                                                                    |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| 20                  | Active Flammability                                                                                                                                                             | The cheesecloth should not be on fire.                                                    | <p>The capacitor should be individually wrapped in at least one but not more than two complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The UAC should be maintained for 2 min. after the last discharge.</p>  <p>C1,2 : 1μF±10%                      C3 : 0.033μF±5% 10kV<br/>L1 to 4 : 1.5mH±20% 16A Rod core choke<br/>Ct : 3μF±5% 10kV                      R : 100Ω±2%<br/>Cx : Capacitor under test              UAC : UR±5%<br/>F : Fuse, Rated 16A                      UR : Rated Voltage<br/>Ut : Voltage applied to Ct</p>  <table><tr><th>Type</th><th>Ui</th></tr><tr><td>GB, GD</td><td>2.5kV</td></tr><tr><td>GC, GF</td><td>5kV</td></tr></table> | Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ui         | GB, GD             | 2.5kV                                      | GC, GF      | 5kV |                                              |
|                     |                                                                                                                                                                                 |                                                                                           | Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Ui                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                    |                                            |             |     |                                              |
| GB, GD              | 2.5kV                                                                                                                                                                           |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| GC, GF              | 5kV                                                                                                                                                                             |                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |
| 21                  | Passive Flammability                                                                                                                                                            | <p>The burning time should not exceed 30 sec.<br/>The tissue paper should not ignite.</p> | <p>The capacitor under test should be held in the flame in the position which best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec.</p> <p>Length of flame : 12±1mm<br/>Gas burner : Length 35mm min.<br/>Inside Dia. 0.5±0.1mm<br/>Outside Dia. 0.9mm max.<br/>Gas : Butane gas Purity 95% min.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                    |                                            |             |     |                                              |

\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

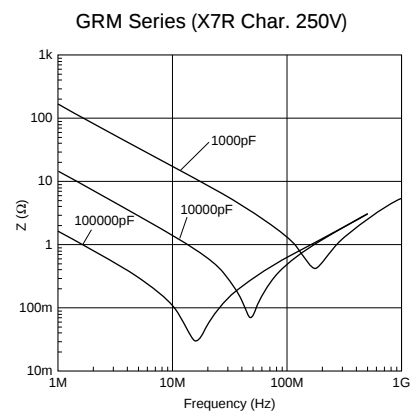
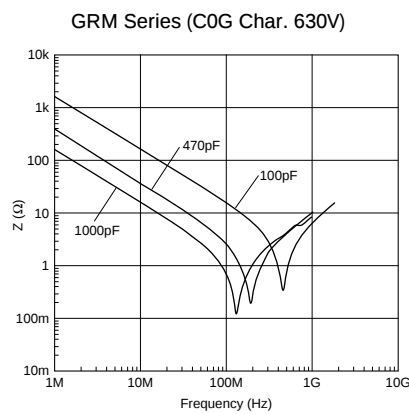
\*2 "C" expresses nominal capacitance value (pF).

## GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

### ■ Capacitance - Temperature Characteristics



### ■ Impedance - Frequency Characteristics



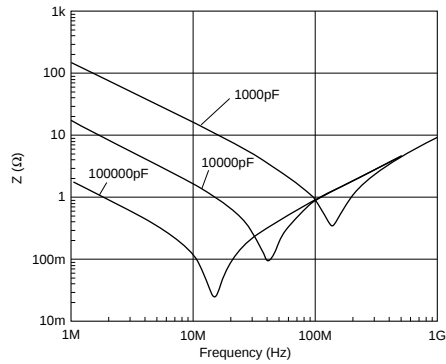
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## GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

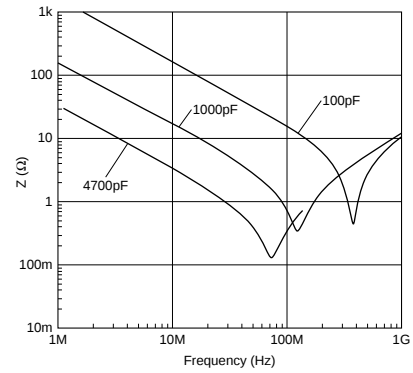
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### ■ Impedance - Frequency Characteristics

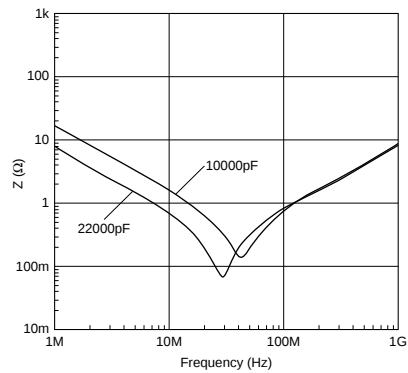
GRM Series (X7R Char. 630V)



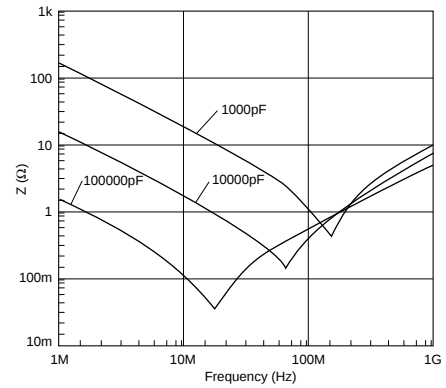
GR4 Series



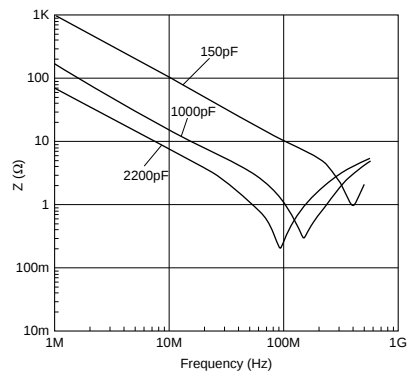
GR7 Series



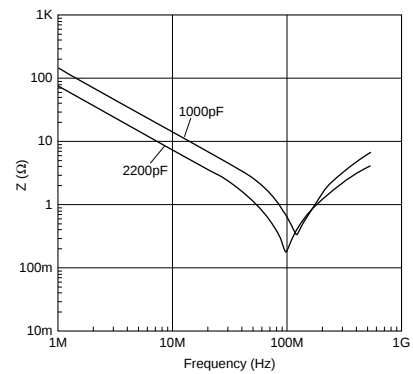
GA2 Series



GA3 Series (Type GD)



GA3 Series (Type GF)



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### GA3 Series (Type GB)



Taping is standard packaging method.

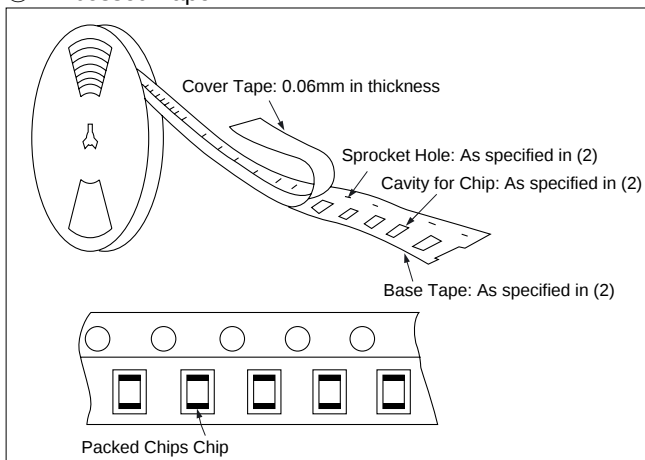
## ■ Minimum Quantity Guide

| Part Number                  |             | Dimensions (mm) |      |      | Quantity (pcs.) |               |
|------------------------------|-------------|-----------------|------|------|-----------------|---------------|
|                              |             |                 |      |      | ø180mm Reel     |               |
|                              |             | L               | W    | T    | Paper Tape      | Embossed Tape |
| Medium Voltage               | GRM18       | 1.6             | 0.8  | 0.8  | 4,000           | -             |
|                              | GRM21       | 2.0             | 1.25 | 1.0  | 4,000           | -             |
|                              |             |                 |      | 1.25 | -               | 3,000         |
|                              | GRM31/GR731 | 3.2             | 1.6  | 1.0  | 4,000           | -             |
|                              |             |                 |      | 1.25 | -               | 3,000         |
|                              |             |                 |      | 1.6  | -               | 2,000         |
|                              | GRM32       | 3.2             | 2.5  | 1.0  | 4,000           | -             |
|                              |             |                 |      | 1.25 | -               | 3,000         |
|                              |             |                 |      | 1.5  | -               | 2,000         |
|                              |             |                 |      | 2.0  | -               | 1,000         |
|                              | GRM42/GR442 | 4.5             | 2.0  | 1.0  | -               | 3,000         |
|                              |             |                 |      | 1.5  | -               | 2,000         |
|                              |             |                 |      | 2.0  | -               | 2,000         |
|                              | GRM43/GR443 | 4.5             | 3.2  | 1.5  | -               | 1,000         |
| 2.0                          |             |                 |      | -    | 1,000           |               |
| 2.5                          |             |                 |      | -    | 500             |               |
| GRM55/GR455                  | 5.7         | 5.0             | 2.0  | -    | 1,000           |               |
| AC250V                       | GA242       | 4.5             | 2.0  | 1.5  | -               | 2,000         |
|                              | GA243       | 4.5             | 3.2  | 1.5  | -               | 1,000         |
|                              |             |                 |      | 2.0  | -               | 1,000         |
|                              | GA255       | 5.7             | 5.0  | 2.0  | -               | 1,000         |
| Safety Std.<br>Certification | GA342       | 4.5             | 2.0  | 1.0  | -               | 3,000         |
|                              |             |                 |      | 1.5  | -               | 2,000         |
|                              |             |                 |      | 2.0  | -               | 2,000         |
|                              | GA343       | 4.5             | 3.2  | 1.5  | -               | 1,000         |
|                              |             |                 |      | 2.0  | -               | 1,000         |
|                              | GA352       | 5.7             | 2.8  | 1.5  | -               | 1,000         |
|                              | GA355       | 5.7             | 5.0  | 1.5  | -               | 1,000         |
|                              |             |                 |      | 2.0  | -               | 1,000         |
|                              |             |                 |      | 2.5  | -               | 500           |
|                              |             |                 |      | 2.7  | -               | 500           |
| 2.9                          |             |                 |      | -    | 500             |               |

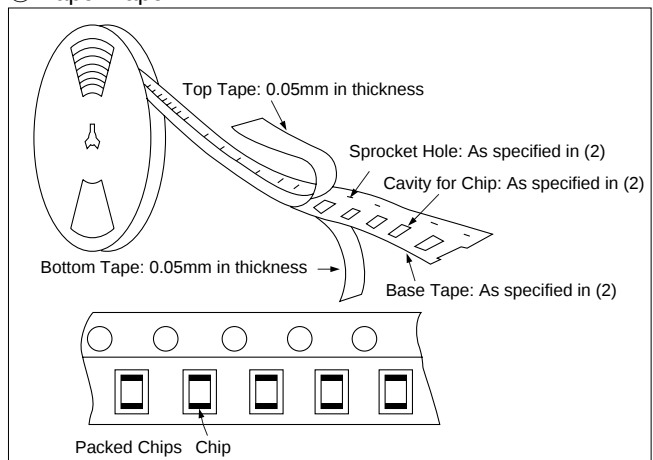
## ■ Tape Carrier Packaging

### (1) Appearance of Taping

### ① Embossed Tape



## ② Paper Tape

Continued on the following page. 

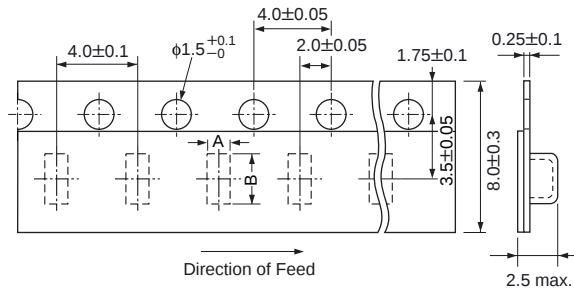
## Package

Continued from the preceding page.

### (2) Dimensions of Tape

#### ① Embossed Tape

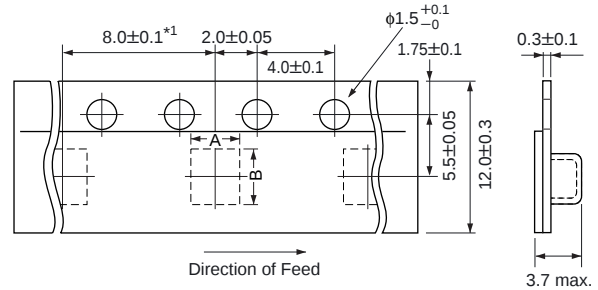
8mm width 4mm pitch Tape



| Part Number                      | A*   | B*   |
|----------------------------------|------|------|
| <b>GRM21</b><br>(T≥1.25mm)       | 1.45 | 2.25 |
| <b>GRM31/GR731</b><br>(T≥1.25mm) | 2.0  | 3.6  |
| <b>GRM32</b><br>(T≥1.25mm)       | 2.9  | 3.6  |

\*Nominal Value

12mm width 8mm/4mm pitch Tape



| Part Number                    | A*  | B*  |
|--------------------------------|-----|-----|
| <b>GRM42/GR442/GA242/GA342</b> | 2.5 | 5.1 |
| <b>GRM43/GR443/GA243/GA343</b> | 3.6 | 4.9 |
| <b>GA352</b>                   | 3.2 | 6.1 |
| <b>GRM55/GR455/GA255/GA355</b> | 5.4 | 6.1 |

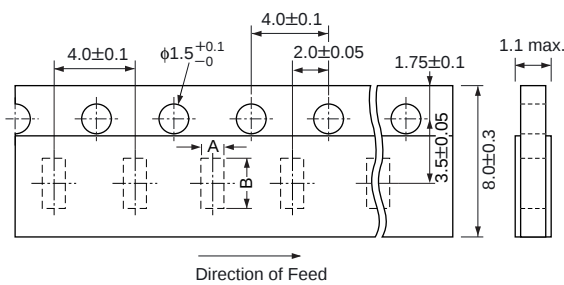
\*1 4.0±0.1mm in case of GRM42/GR442/GA242/GA342

\*Nominal Value

(in mm)

#### ② Paper Tape

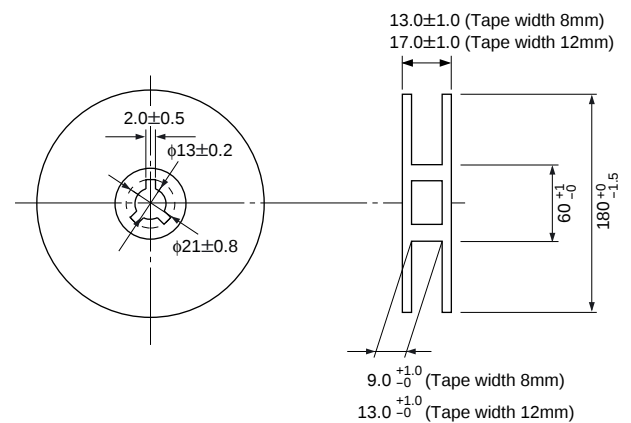
8mm width 4mm pitch Tape



| Part Number                     | A*   | B*   |
|---------------------------------|------|------|
| <b>GRM18</b>                    | 1.05 | 1.85 |
| <b>GRM21</b><br>(T=1.0mm)       | 1.45 | 2.25 |
| <b>GRM31/GR731</b><br>(T=1.0mm) | 2.0  | 3.6  |
| <b>GRM32</b><br>(T=1.0mm)       | 2.9  | 3.6  |

\*Nominal Value  
(in mm)

### (3) Dimensions of Reel



(in mm)

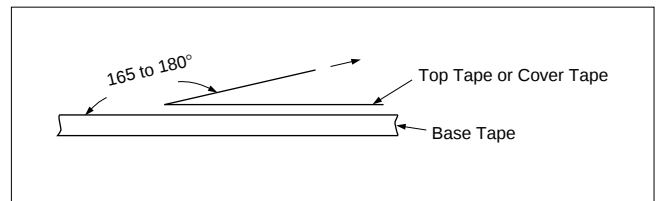
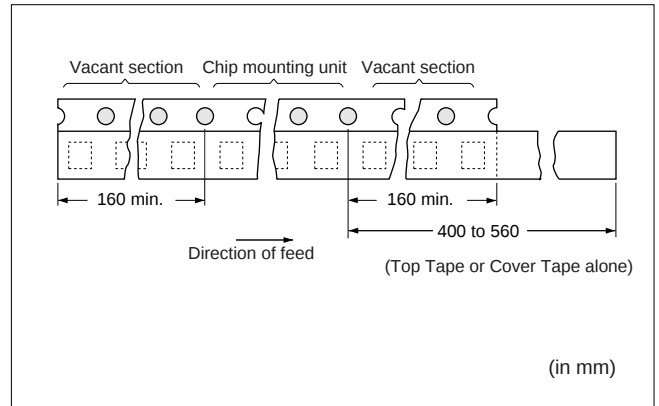
Continued on the following page. ➤

## Package

Continued from the preceding page.

### (4) Taping Method

- ① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
- ② Part of the leader and part of the empty tape should be attached to the end of the tape as shown at right.
- ③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- ④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
- ⑤ The top tape or cover tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.
- ⑥ Cumulative tolerance of sprocket holes, 10 pitches:  $\pm 0.3\text{mm}$ .
- ⑦ Peeling off force: 0.1 to 0.6N in the direction shown at right.



## Caution

### ■ Storage and Operating Conditions

#### Operating and storage environment

Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture. Before cleaning, bonding or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed 5 to 40 degrees centigrade and 20 to 70%.

Use capacitors within 6 months after delivered.

Check the solderability after 6 months or more.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ Handling

#### 1. Vibration and impact

Do not expose a capacitor to excessive shock or vibration during use.

#### 2. Do not directly touch the chip capacitor, especially the ceramic body. Residue from hands/fingers may create a short circuit environment.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

■ Caution (Rating)

## 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-p which contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

When DC-rated capacitors are to be used in input circuits from commercial power source (AC filter), be sure to use Safety Certified Capacitors because various regulations on withstand voltage or impulse withstand established for each equipment should be taken into considerations.

| Voltage                | DC Voltage                                                                        | DC+AC Voltage                                                                     | AC Voltage                                                                        | Pulse Voltage (1)                                                                   | Pulse Voltage (2)                                                                   |
|------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Positional Measurement |  |  |  |  |  |

## 2. Operating Temperature, Self-generated Heat, and Load Reduction at High-frequency Voltage Condition

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range.

Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency voltage, pulse voltage, it may self-generate heat due to dielectric loss.

(1) In case of X7R char.

Applied voltage should be the load such as self-generated heat is within 20°C on the condition of atmosphere temperature 25°C. When measuring, use a thermocouple of small thermal capacity -K of  $\varnothing 0.1\text{mm}$  in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

Continued on the following page. 

## Caution

Continued from the preceding page.

### (2) In case of C0G, U2J char.

Due to the low self-heating characteristics of low-dissipation capacitors, the allowable electric power of these capacitors is generally much higher than that of X7R characteristic capacitors.

When a high frequency voltage which cause 20°C self heating to the capacitor is applied, it will exceed capacitor's allowable electric power.

The frequency of the applied sine wave voltage should be less than 500kHz (less than 100kHz in case of rated voltage: DC3.15kV). The applied voltage should be less than the value shown in figure below.

While, in case of non-sine wave which include a harmonic frequency, please contact our sales representatives or product engineers. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

<C0G char., Rated Voltage: DC3.15kV>

The capacitors less than 22pF can be applied maximum 4.0kV peak to peak at 100kHz or less only for the ballast or the resonance usage in the LCD backlight inverter circuit.

<Capacitor Selection Tool>

We are also offering free software the "capacitor selection tool: Murata Medium Voltage Capacitors Selection Tool by Voltage Form (\*)" which will assist you in selecting a suitable capacitor.

The software can be downloaded from Murata's Internet Website.

([http://www.murata.com/designlib/mmcsv\\_e.html](http://www.murata.com/designlib/mmcsv_e.html)).

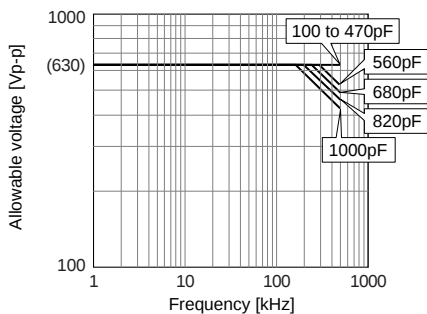
By inputting capacitance values and applied voltage waveform of the specific capacitor series, this software will calculate the capacitor's power consumption and list suitable capacitors (non-sine wave is also available).

\* Subject series are below.

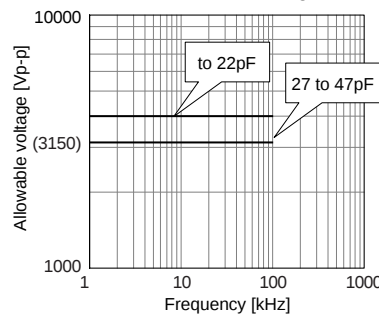
· Temperature Characteristics C0G, U2J

The temperature of the surface of capacitor: 125°C or less (including self-heating)

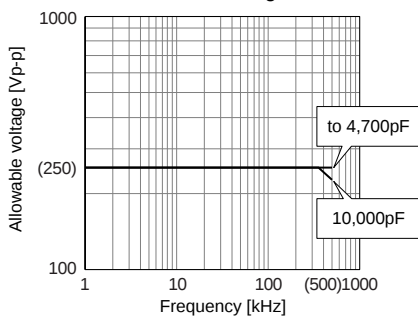
C0G char., Rated Voltage: DC630V



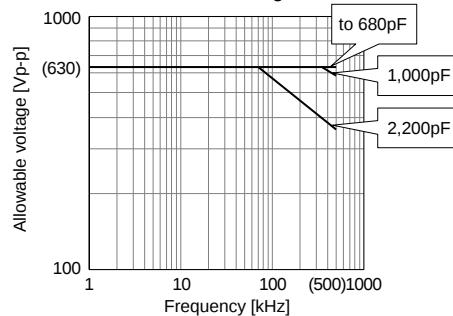
C0G char., Rated Voltage: DC3.15kV



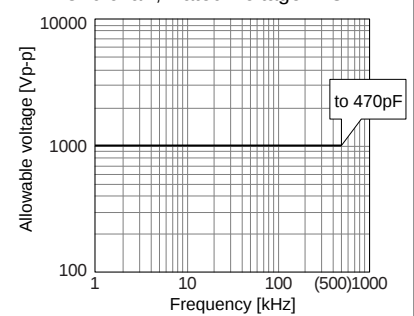
U2J char., Rated Voltage: DC250V



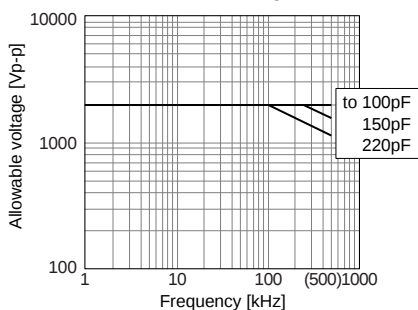
U2J char., Rated Voltage: DC630V



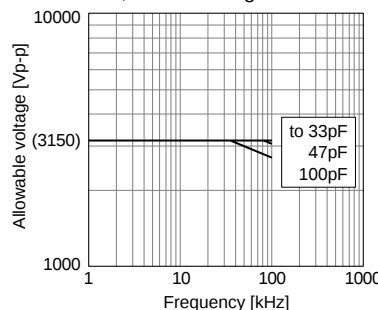
U2J char., Rated Voltage: DC1kV



U2J char., Rated Voltage: DC2kV



U2J char., Rated Voltage: DC3.15kV



The sine-wave frequency VS allowable voltage

Continued on the following page.

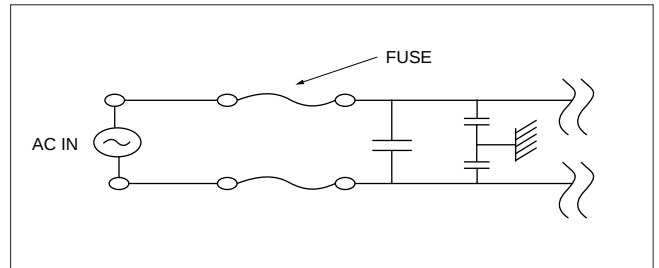
## Caution

Continued from the preceding page.

### 3. Fail-safe

Failure of a capacitor may result in a short circuit. Be sure to provide an appropriate fail-safe function such as a fuse on your product to help eliminate possible electric shock, fire, or fumes.

Please consider using fuses on each AC line if the capacitors are used between the AC input lines and earth (line bypass capacitors), to prepare for the worst case, such as a short circuit.



### 4. Test Condition for AC Withstanding Voltage

#### (1) Test Equipment

Tests for AC withstanding voltage should be made with equipment capable of creating a wave similar to a 50/60 Hz sine wave.

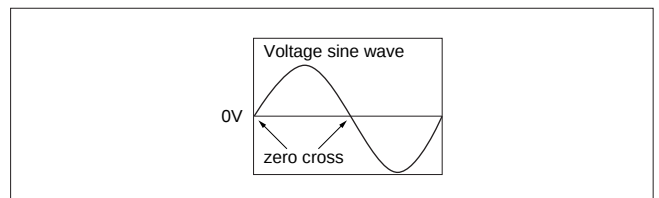
If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

#### (2) Voltage Applied Method

The capacitor's leads or terminals should be firmly connected to the output of the withstanding voltage test equipment, and then the voltage should be raised from near zero to the test voltage. If the test voltage is applied directly to the capacitor without raising it from near zero, it should be applied with the zero cross\*. At the end of the test time, the test voltage should be reduced to near zero, and then the capacitor's leads or terminals should be taken off the output of the withstanding voltage test equipment. If the test voltage is applied directly to the capacitor without raising it from near zero, surge voltage may occur and cause a defect.

\*ZERO CROSS is the point where voltage sine wave pass 0V.

- See the figure at right -



FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

## ⚠ Caution

### ■ Caution (Soldering and Mounting)

#### 1. Vibration and Impact

Do not expose a capacitor to excessive shock or vibration during use.

#### 2. Circuit Board Material

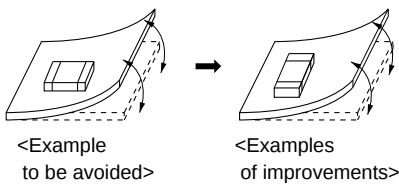
It is possible for the chip to crack by the expansion and shrinkage of a metal board.

Please contact us if you want to use our ceramic capacitors on a metal board such as Aluminum.

#### 3. Land Layout for Cropping PC Board

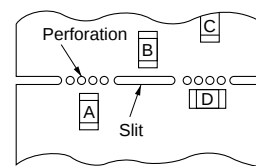
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

##### [Component Direction]



Locate chip horizontal to the direction in which stress acts.

##### [Chip Mounting Close to Board Separation Point]



Chip arrangement  
 Worst A>C>B~D Best

Continued on the following page.

- When sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 1. It is required to keep temperature differential between the soldering and the components surface ( $\Delta T$ ) as small as possible.
- Solderability of Tin plating termination chip might be deteriorated when low temperature soldering profile where peak solder temperature is below the Tin melting point is used. Please confirm the solderability of Tin plating termination chip before use.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference ( $\Delta T$ ) between the component and solvent within the range shown in the Table 1.

| Part Number       | Temperature Differential            |
|-------------------|-------------------------------------|
| G□□18/21/31       | $\Delta T \leq 190^{\circ}\text{C}$ |
| G□□32/42/43/52/55 | $\Delta T \leq 130^{\circ}\text{C}$ |

|                  | Pb-Sn Solder    |              | Lead Free Solder      |
|------------------|-----------------|--------------|-----------------------|
|                  | Infrared Reflow | Vapor Reflow |                       |
| Peak Temperature | 230-250°C       | 230-240°C    | 240-260°C             |
| Atmosphere       | Air             | Air          | Air or N <sub>2</sub> |

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 Continued from the preceding page.

- When sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. And an excessively long soldering time or high soldering temperature results in leaching by the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 2. It is required to keep temperature differential between the soldering and the components surface ( $\Delta T$ ) as small as possible.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.

Do not apply flow soldering to chips not listed in Table 2.

|             |                                     |
|-------------|-------------------------------------|
| Part Number | Temperature Differential            |
| G 18/21/31  | $\Delta T \leq 150^{\circ}\text{C}$ |

|                  | Pb-Sn Solder | Lead Free Solder |
|------------------|--------------|------------------|
| Peak Temperature | 240-250°C    | 250-260°C        |
| Atmosphere       | Air          | N <sub>2</sub>   |

- **Optimum Solder Amount for Flow Soldering**  
The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions.

The graph illustrates the temperature profile for soldering. The y-axis represents Temperature in degrees Celsius (°C), with marked values at 130°C, 150°C, and 170°C. The x-axis represents Time. The process is divided into three main phases:

- Preheating:** This phase starts at a temperature below 130°C and rises to 150°C. The duration is specified as 60-120 seconds. A shaded area indicates the temperature range during this phase.
- Soldering:** The temperature rises sharply from 150°C to a peak labeled 'Soldering' (above 170°C). The duration for this phase is specified as 5 seconds max.
- Gradual Cooling:** This phase is represented by a dashed line showing the temperature decreasing after the soldering process.

A vertical double-headed arrow labeled  $\Delta T$  indicates the temperature difference between 150°C and 170°C.

A line graph showing the relationship between Soldering Temperature (°C) and Soldering Time (sec.). The y-axis ranges from 230 to 270 in increments of 10. The x-axis ranges from 0 to 30 in increments of 10. A curve starts at (5, 270) and decreases to (22, 230). The area under the curve is shaded with diagonal lines.

| Soldering Time (sec.) | Soldering Temperature (°C) |
|-----------------------|----------------------------|
| 5                     | 270                        |
| 10                    | 265                        |
| 15                    | 255                        |
| 20                    | 245                        |
| 22                    | 230                        |

Up to Chip Thickness

Adhesive

in section

***muRata***

- When sudden heat is applied to the components by use of a soldering iron, the mechanical strength of the components will go down because the extreme temperature change causes deformations inside the components.

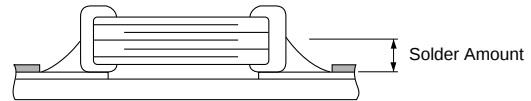
Preheating conditions, (The "Temperature of the Soldering Iron Tip", "Preheating Temperature", "Temperature Differential" between iron tip and the

The operating time for the re-working should be as short as possible. When re-working time is too long, it may cause solder leaching, and that will cause a reduction of the adhesive strength of the terminations.

| Part Number           | Temperature of Soldering Iron tip | Preheating Temperature | Temperature Differential ( $\Delta T$ ) | Atmosphere |
|-----------------------|-----------------------------------|------------------------|-----------------------------------------|------------|
| G□□18/21/31           | 350°C max.                        | 150°C min.             | $\Delta T \leq 190^\circ\text{C}$       | air        |
| G□□32/42/43/<br>52/55 | 280°C max.                        | 150°C min.             | $\Delta T \leq 130^\circ\text{C}$       | air        |

Lead Free Solder: Sn-3.0Ag-0.5Cu

- Solder wire with  $\varnothing 0.5\text{mm}$  or smaller is required for soldering.



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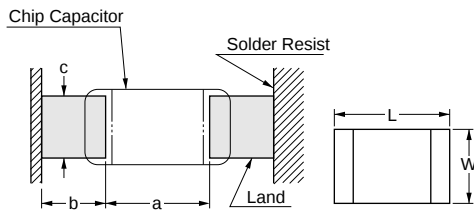
## Notice

### ■ Notice (Soldering and Mounting)

#### 1. Construction of Board Pattern

After installing chips, if solder is excessively applied to the circuit board, mechanical stress will cause destruction resistance characteristics to lower. To prevent this, be extremely careful in determining shape and dimension before designing the circuit board diagram.

#### Construction and Dimensions of Pattern (Example)



#### Flow Soldering

| L×W      | a       | b       | c       |
|----------|---------|---------|---------|
| 1.6×0.8  | 0.6-1.0 | 0.8-0.9 | 0.6-0.8 |
| 2.0×1.25 | 1.0-1.2 | 0.9-1.0 | 0.8-1.1 |
| 3.2×1.6  | 2.2-2.6 | 1.0-1.1 | 1.0-1.4 |

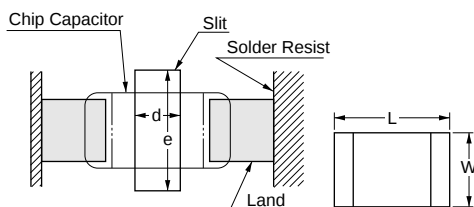
Flow soldering : 3.2×1.6 or less available.

#### Reflow Soldering

| L×W      | a       | b       | c       |
|----------|---------|---------|---------|
| 1.6×0.8  | 0.6-0.8 | 0.6-0.7 | 0.6-0.8 |
| 2.0×1.25 | 1.0-1.2 | 0.6-0.7 | 0.8-1.1 |
| 3.2×1.6  | 2.2-2.4 | 0.8-0.9 | 1.0-1.4 |
| 3.2×2.5  | 2.0-2.4 | 1.0-1.2 | 1.8-2.3 |
| 4.5×2.0  | 2.8-3.4 | 1.2-1.4 | 1.4-1.8 |
| 4.5×3.2  | 2.8-3.4 | 1.2-1.4 | 2.3-3.0 |
| 5.7×2.8  | 4.0-4.6 | 1.4-1.6 | 2.1-2.6 |
| 5.7×5.0  | 4.0-4.6 | 1.4-1.6 | 3.5-4.8 |

(in mm)

#### Dimensions of Slit (Example)



Preparing slit helps flux cleaning and resin coating on the back of the capacitor.  
 But, the length of slit design should be shorter enough as much as possible to prevent the mechanical damage in the capacitor.  
 The longer slit design might receive more severe mechanical stress from the PCB.  
 Recommendable slit design is shown in the Table.

| L×W      | d       | e       |
|----------|---------|---------|
| 1.6×0.8  | -       | -       |
| 2.0×1.25 | -       | -       |
| 3.2×1.6  | 1.0-2.0 | 3.2-3.7 |
| 3.2×2.5  | 1.0-2.0 | 4.1-4.6 |
| 4.5×2.0  | 1.0-2.8 | 3.6-4.1 |
| 4.5×3.2  | 1.0-2.8 | 4.8-5.3 |
| 5.7×2.8  | 1.0-4.0 | 4.4-4.9 |
| 5.7×5.0  | 1.0-4.0 | 6.6-7.1 |

(in mm)

Continued on the following page.



## Notice

 Continued from the preceding page.

### 4. Cleaning

Please confirm there is no problem in the reliability of the product beforehand when cleaning it with the intended equipment.

The residue after cleaning it might cause the decrease in the surface resistance of the chip and the corrosion of the electrode part, etc. As a result it might cause reliability to deteriorate. Please confirm beforehand that there is no problem with the intended equipment in ultrasonic cleansing.

### 5. Resin Coating

Please use it after confirming there is no influence on the product with a intended equipment beforehand when the resin coating and molding.

A cracked chip might be caused at the cooling/heating cycle by the amount of resin spreading and/or bias thickness.

The resin for coating and molding must be selected as the stress is small when stiffening and the hygroscopic is low as possible.

## ■ Rating

### 1. Capacitance change of capacitor

#### (1) In case of X7R char.

Capacitors have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. So, it is not likely to be suitable for use in a time constant circuit.

Please contact us if you need detailed information.

#### (2) In case of any char. except X7R

Capacitance might change a little depending on the surrounding temperature or an applied voltage.

Please contact us if you intend to use this product in a strict time constant circuit.

### 2. Performance check by equipment

Before using a capacitor, check that there is no problem in the equipment's performance and the specifications.

Generally speaking, CLASS 2 (X7R char.) ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance. So, the capacitance value may change depending on the operating condition in the equipment. Therefore, be sure to confirm the apparatus performance of receiving influence in a capacitance value change of a capacitor, such as leakage current and noise suppression characteristics.

Moreover, check the surge-proof ability of a capacitor in the equipment, if needed, because the surge voltage may exceed specific value by the inductance of the circuit.

## ISO 9001 Certifications

### ■ Qualified Standards

The products listed here have been produced by ISO 9001 certified factory.

| Plant                                    |
|------------------------------------------|
| Fukui Murata Mfg. Co., Ltd.              |
| Izumo Murata Mfg. Co., Ltd.              |
| Okayama Murata Mfg. Co., Ltd.            |
| Murata Electronics Singapore (Pte.) Ltd. |
| Beijing Murata Electronics Co., Ltd.     |
| Wuxi Murata Electronics Co., Ltd.        |

⚠Note:

1. Export Control

<For customers outside Japan>

No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.

<For customers in Japan>

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- |                             |                                                                                                      |
|-----------------------------|------------------------------------------------------------------------------------------------------|
| ① Aircraft equipment        | ② Aerospace equipment                                                                                |
| ③ Undersea equipment        | ④ Power plant equipment                                                                              |
| ⑤ Medical equipment         | ⑥ Transportation equipment (vehicles, trains, ships, etc.)                                           |
| ⑦ Traffic signal equipment  | ⑧ Disaster prevention / crime prevention equipment                                                   |
| ⑨ Data-processing equipment | ⑩ Application of similar complexity and/or reliability requirements to the applications listed above |

3. Product specifications in this catalog are as of Jul 2009. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.

4. Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.



**Murata Manufacturing Co., Ltd.**

<http://www.murata.com/>

**Head Office**

1-10-1, Higashi Kotari, Nagaokakyo-shi, Kyoto 617-8555, Japan  
Phone: 81-75-951-9111

**International Division**

3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan  
Phone: 81-3-5469-6123 Fax: 81-3-5469-6155 E-mail: [intl@murata.co.jp](mailto:intl@murata.co.jp)