

# DATA SHEET

## **SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS**

C-Array

NP0/X7R/Y5V

16 V TO 50 V

sizes 0508 (4 x 0402) / 0612 (4 x 0603)

RoHS compliant & Halogen Free



## SCOPE

This specification describes NP0/X7R/Y5V 4-capacitor Array with lead-free terminations.

## APPLICATIONS

- Professional electronics
- High density consumer electronics

## FEATURES

- Supplied in tape on reel
- Nickel-barrier end termination
- 0508 (4x0402) / 0612 (4x0603) capacitors (of the same capacitance value) per array
- Less than 50% board space of an equivalent discrete component
- High volumetric efficiency
- Increased throughput, by time saved in mounting
- RoHS compliant
- Halogen Free compliant

## ORDERING INFORMATION - GLOBAL PART NUMBER, PHYCOMP

### CTC & I2NC

All part numbers are identified by the series, size, tolerance, TC material, packing style, voltage, process code, termination and capacitance value. Please note that 12 digits ordering code will expire at the end of 2010.

### YAGEO BRAND ordering code

### GLOBAL PART NUMBER (PREFERRED)

CA XXXX X X XXX X B X XXX  
(1) (2) (3) (4) (5) (6) (7)

### (1) SIZE – INCH BASED (METRIC)

0508 (1220)

0612 (1632)

### (2) TOLERANCE

J =  $\pm 5\%$

K =  $\pm 10\%$

M =  $\pm 20\%$

Z = -20% to +80%

### (3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch

### (4) TC MATERIAL

NPO

X7R

Y5V

### (5) RATED VOLTAGE

7 = 16 V

8 = 25 V

9 = 50 V

### (6) PROCESS

N = NP0

B = X7R / Y5V

### (7) CAPACITANCE VALUE

2 significant digits+number of zeros

The 3rd digit signifies the multiplying factor, and letter R is decimal point

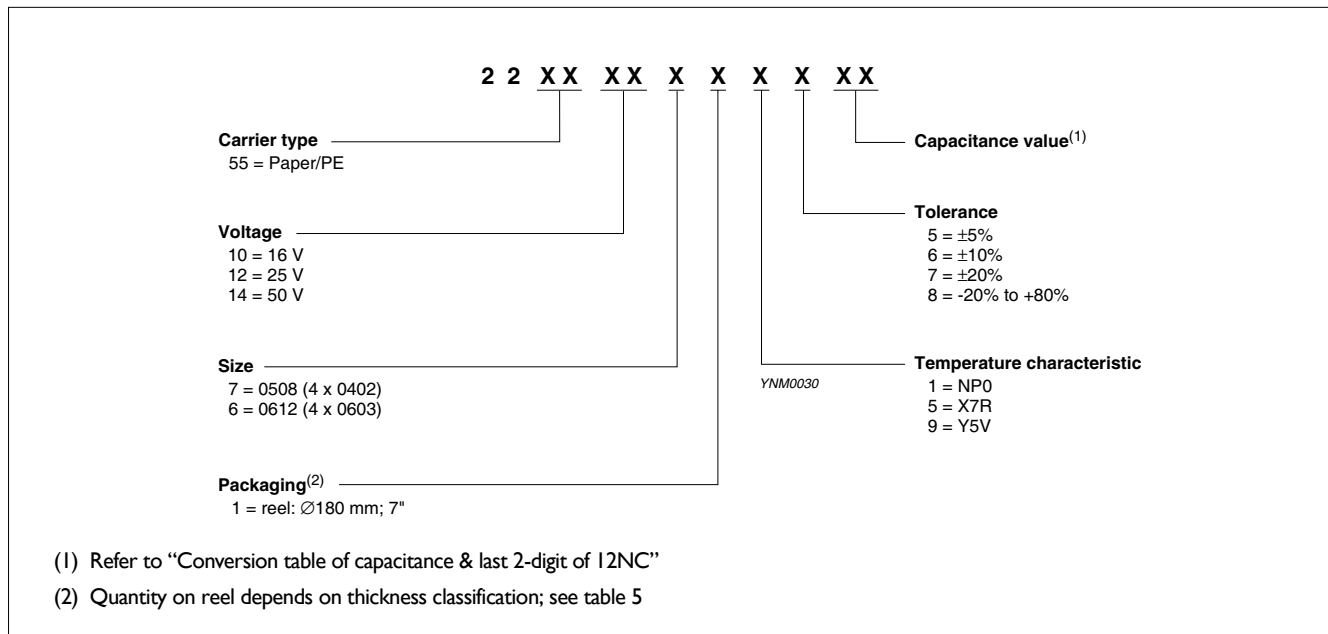
Example: 121 =  $12 \times 10^1 = 120 \text{ pF}$

**PHYCOMP BRAND ordering codes**

GLOBAL PART NUMBER (preferred), PHYCOMP CTC (for North America) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

**GLOBAL PART NUMBER (PREFERRED)**

For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

**I2NC CODE****PHYCOMP CTC CODE (FOR NORTH AMERICA)**

🔗 Example: 0508CG220K9B200

| 0508               | CG                   | 220                                                                                                                         | K                                                   | 9                                | B           | 2                         | 0              | 0                                     |
|--------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|----------------------------------|-------------|---------------------------|----------------|---------------------------------------|
| Size code          | Temp. Char.          | Capacitance in pF                                                                                                           | Tolerance                                           | Voltage                          | Termination | Packing                   | Marking        | Range identifier                      |
| 0508<br>(4 x 0402) | CG = NP0<br>2R = X7R | 101 = 100 pF;<br>the third digit<br>signifies the<br>multiplying factor:<br>0 = × 1<br>1 = × 10<br>2 = × 100<br>3 = × 1,000 | J = ±5%<br>K = ±10%<br>M = ±20%<br>Z = -20% to +80% | 7 = 16 V<br>8 = 25 V<br>9 = 50 V | B = NiSn    | 2 = 180 mm<br>7" Paper/PE | 0 = no marking | 0 = conv. Ceramic<br>D = Class 2 MLCC |

## CONSTRUCTION

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved metal electrodes are contained. This structure gives rise to a high capacitance per unit volume.

The inner electrodes are connected to the two end terminations and finally covered with a layer of plated tin (NiSn).

The terminations are lead-free.

An outline of the structure is shown in Fig. I.

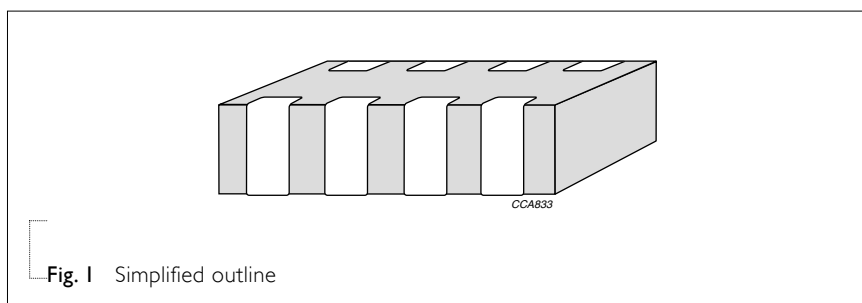


Fig. I Simplified outline

## DIMENSIONS

Table I

| TYPE                   | 0508<br>(4 X 0402) | 0612<br>(4 X 0603) |
|------------------------|--------------------|--------------------|
| L (mm)                 | 2.0 ±0.15          | 3.2 ±0.15          |
| W (mm)                 | 1.25 ±0.15         | 1.60 ±0.15         |
| T <sub>min.</sub> (mm) | 0.50               | 0.70               |
| T <sub>max.</sub> (mm) | 0.70               | 0.90               |
| A (mm)                 | 0.28 ±0.10         | 0.4 ±0.10          |
| B (mm)                 | 0.2 ±0.10          | 0.3 ±0.20          |
| P (mm)                 | 0.5 ±0.10          | 0.8 ±0.10          |

## OUTLINES

For dimensions see Table I

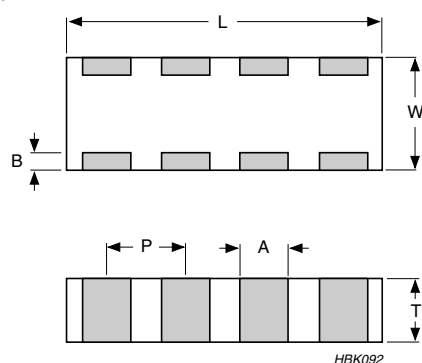


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

**CAPACITANCE RANGE & THICKNESS FOR 4C-ARRAY****Table 2** Temperature characteristic material from NP0

| CAPACITANCE | Last 2-digit of | 0508 (4 × 0402) |         | 0612 (4 × 0603) |         |
|-------------|-----------------|-----------------|---------|-----------------|---------|
|             |                 | I2NC            | 50 V    | 50 V            |         |
| 10 pF       | 23              |                 |         |                 |         |
| 15 pF       | 25              |                 |         |                 |         |
| 18 pF       | 26              |                 |         |                 |         |
| 22 pF       | 27              |                 |         |                 |         |
| 33 pF       | 29              |                 |         |                 |         |
| 39 pF       | 31              |                 |         |                 |         |
| 47 pF       | 32              |                 |         |                 |         |
| 56 pF       | 33              |                 | 0.6±0.1 |                 |         |
| 68 pF       | 34              |                 |         |                 |         |
| 82 pF       | 35              |                 |         |                 | 0.8±0.1 |
| 100 pF      | 36              |                 |         |                 |         |
| 120 pF      | 37              |                 |         |                 |         |
| 150 pF      | 38              |                 |         |                 |         |
| 180 pF      | 39              |                 |         |                 |         |
| 220 pF      | 41              |                 |         |                 |         |
| 270 pF      | 42              |                 |         |                 |         |
| 330 pF      | 43              |                 |         |                 |         |
| 390 pF      | 44              |                 |         |                 |         |
| 470 pF      | 45              |                 |         |                 |         |
| 560 pF      | 46              |                 |         |                 |         |
| 680 pF      | 47              |                 |         |                 |         |
| 820 pF      | 48              |                 |         |                 |         |
| 1.0 nF      | 49              |                 |         |                 |         |

**NOTE**

Values in shaded cells indicate thickness class in mm

**CAPACITANCE RANGE & THICKNESS FOR 4C-ARRAY****Table 3** Temperature characteristic material from X7R

| CAPACITANCE | Last 2-digit of | 0508 (4 × 0402) | 0612 (4 × 0603) |         |         |
|-------------|-----------------|-----------------|-----------------|---------|---------|
|             | I2NC            | 16 V            | 16 V            | 25 V    | 50 V    |
| 180 pF      | 13              |                 |                 |         |         |
| 220 pF      | 14              |                 |                 |         |         |
| 270 pF      | 15              |                 |                 |         |         |
| 330 pF      | 16              |                 |                 |         |         |
| 390 pF      | 17              |                 |                 |         |         |
| 470 pF      | 18              |                 |                 |         |         |
| 560 pF      | 19              |                 |                 |         |         |
| 680 pF      | 21              |                 |                 |         |         |
| 820 pF      | 22              |                 |                 |         |         |
| 1.0 nF      | 23              |                 |                 |         |         |
| 1.2 nF      | 24              |                 |                 |         |         |
| 1.5 nF      | 25              |                 |                 |         |         |
| 1.8 nF      | 26              |                 |                 |         |         |
| 2.2 nF      | 27              |                 |                 |         |         |
| 2.7 nF      | 28              |                 |                 |         |         |
| 3.3 nF      | 29              | 0.6±0.1         |                 | 0.8±0.1 | 0.8±0.1 |
| 3.9 nF      | 31              |                 |                 |         |         |
| 4.7 nF      | 32              |                 |                 |         |         |
| 5.6 nF      | 33              |                 |                 |         |         |
| 6.8 nF      | 34              |                 |                 |         |         |
| 8.2 nF      | 35              |                 |                 |         |         |
| 10 nF       | 36              |                 |                 |         |         |
| 12 nF       | 37              |                 |                 |         |         |
| 15 nF       | 38              |                 |                 |         |         |
| 18 nF       | 39              |                 |                 |         |         |
| 22 nF       | 41              |                 |                 |         |         |
| 27 nF       | 42              |                 |                 |         |         |
| 33 nF       | 43              |                 | 0.8±0.1         |         |         |
| 47 nF       | 45              |                 |                 |         |         |
| 56 nF       | 46              |                 |                 |         |         |
| 68 nF       | 47              |                 |                 |         |         |
| 82 nF       | 48              |                 |                 |         |         |
| 100 nF      | 49              |                 |                 |         |         |

**NOTE**

Values in shaded cells indicate thickness class in mm

CAPACITANCE RANGE & THICKNESS FOR 4C-ARRAY

Table 4 Temperature characteristic material from Y5V

| CAPACITANCE |    | Last 2-digit of | 0612 (4 x 0603) |
|-------------|----|-----------------|-----------------|
|             |    | I2NC            | 25 V            |
| 10 nF       | 36 | 0.6±0.1         |                 |
| 22 nF       | 41 |                 |                 |
| 47 nF       | 45 |                 |                 |
| 100 nF      | 49 |                 |                 |

**NOTE**

Values in shaded cells indicate thickness class in mm

THICKNESS CLASSES AND PACKING QUANTITY

Table 5

| SIZE<br>CODE | THICKNESS<br>CLASSIFICATION | TAPE WIDTH QUANTITY<br>PER REEL | Ø180 MM / 7 INCH<br>Paper |
|--------------|-----------------------------|---------------------------------|---------------------------|
| 0508         | 0.6 ±0.1 mm                 | 8 mm                            | 4,000                     |
| 0612         | 0.8 ±0.1 mm                 | 8 mm                            | 4,000                     |

ELECTRICAL CHARACTERISTICS**4C-ARRAY DIELECTRIC CAPACITORS; NISN TERMINATIONS**

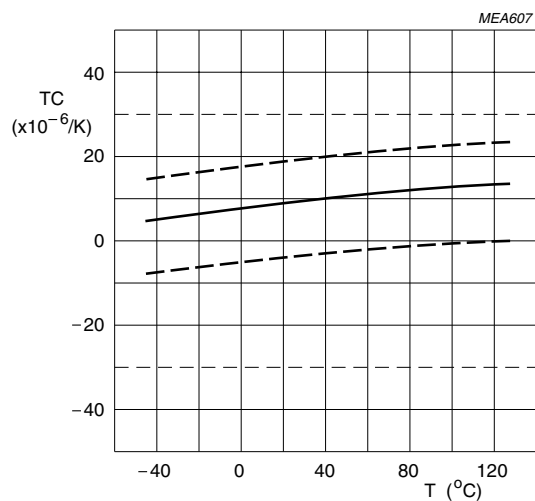
Unless otherwise stated all electrical values apply at an ambient temperature of  $20 \pm 1$  °C, an atmospheric pressure of 86 to 106 kPa, and a relative humidity of 63 to 67%.

Table 6

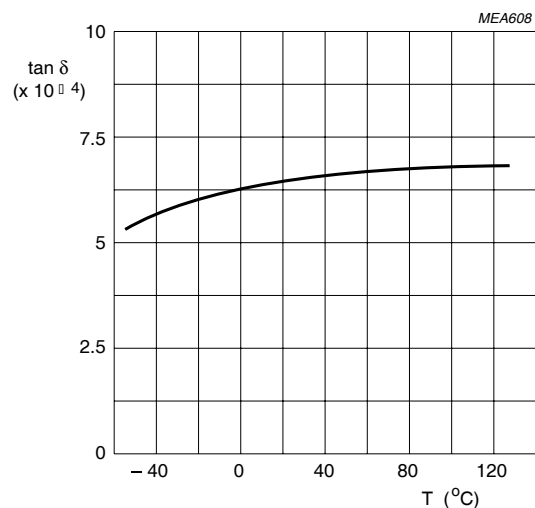
| DESCRIPTION                                                                                       | VALUE                                                                                       |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Capacitance range                                                                                 | 10 pF to 100 nF                                                                             |
| Rated voltage                                                                                     |                                                                                             |
| NP0                                                                                               | 50 V                                                                                        |
| X7R                                                                                               | 0508: 16 V, 0612: 16 V to 50 V                                                              |
| Y5V                                                                                               | 0612: 25 V                                                                                  |
| Capacitance tolerance                                                                             |                                                                                             |
| NP0                                                                                               | $\pm 5\%$ , $\pm 10\%$                                                                      |
| X7R                                                                                               | $\pm 10\%$ , $\pm 20\%$                                                                     |
| Y5V                                                                                               | $-20\%$ to $+80\%$                                                                          |
| Dissipation factor (D.F.)                                                                         |                                                                                             |
| NP0                                                                                               | $\leq 0.1\%$                                                                                |
| X7R                                                                                               | $16\text{ V} \leq 3.5\%$ , $25\text{ V} \leq 2.5\%$ , $50\text{ V} \leq 2.5\%$              |
| Y5V                                                                                               | $0508 \leq 9\%$ , $0612 \leq 7\%$                                                           |
| Insulation resistance after 1 minute at $U_r$ (DC)                                                | $R_{ins} \geq 10\text{ G}\Omega$ or $R_{ins} \times C_r \geq 500$ seconds whichever is less |
| Maximum capacitance change as a function of temperature (temperature characteristic/coefficient): |                                                                                             |
| NP0                                                                                               | $\pm 30\text{ ppm}/^\circ\text{C}$                                                          |
| X7R                                                                                               | $\pm 15\%$                                                                                  |
| Y5V                                                                                               | $+22\%$ to $-82\%$                                                                          |
| Operating temperature range:                                                                      |                                                                                             |
| NP0                                                                                               | $-55\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$                                 |
| X7R                                                                                               | $-55\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$                                 |
| Y5V                                                                                               | $-30\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$                                  |

**NP0 0508/0612 50 V**

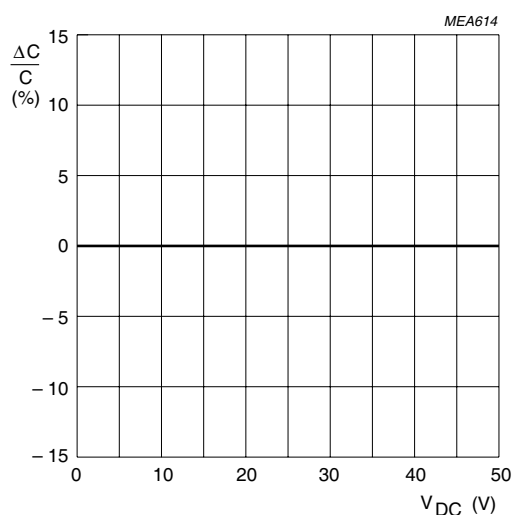
Sample limits (broken lines)  
Requirement levels (dotted lines)



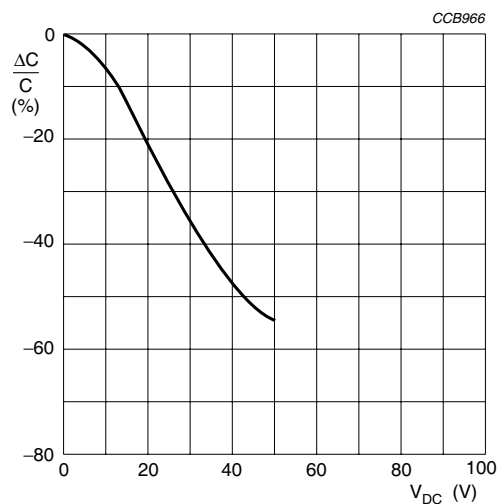
**Fig. 3** Typical temperature coefficient as a function of temperature



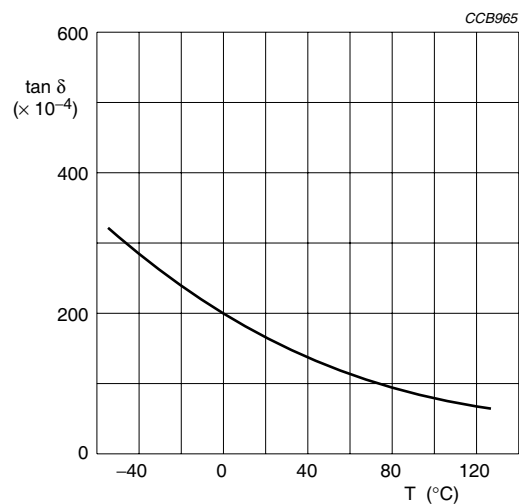
**Fig. 4** Typical tan δ as a function of temperature



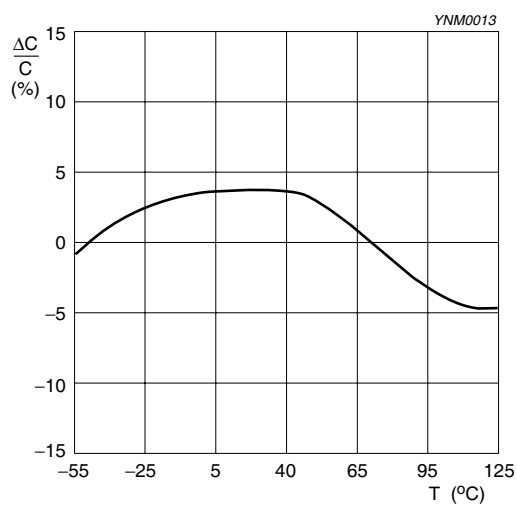
**Fig. 5** Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage

**X7R 0508 16 V**


**Fig. 6** Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C



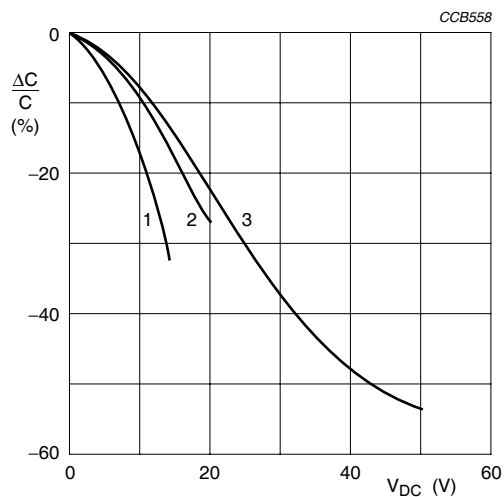
**Fig. 7** Typical  $\tan \delta$  as a function of temperature



**Fig. 8** Typical capacitance change as a function of temperature

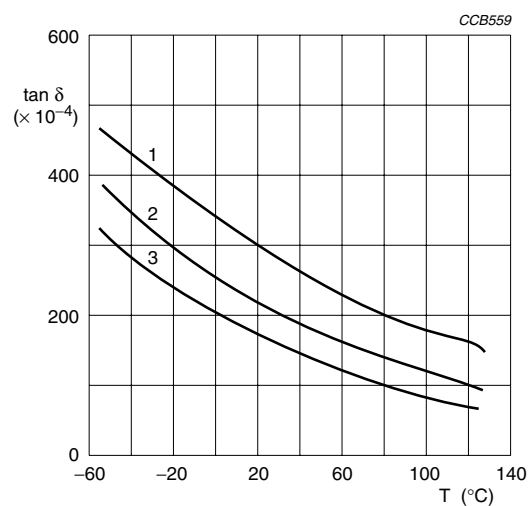
**X7R 0612 16 V to 50 V**

Curve 1 = 16 V product  
Curve 2 = 25 V product  
Curve 3 = 50 V product

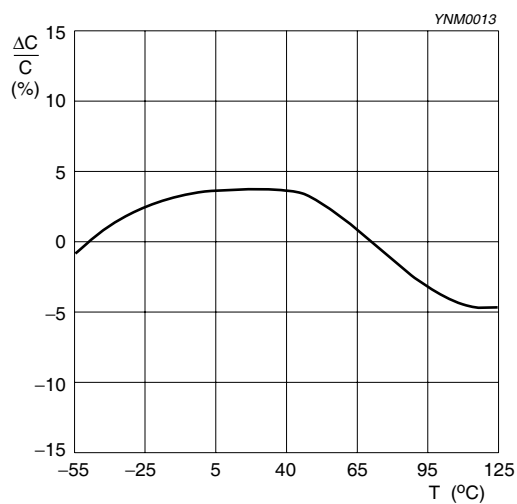


**Fig. 9** Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 25 °C

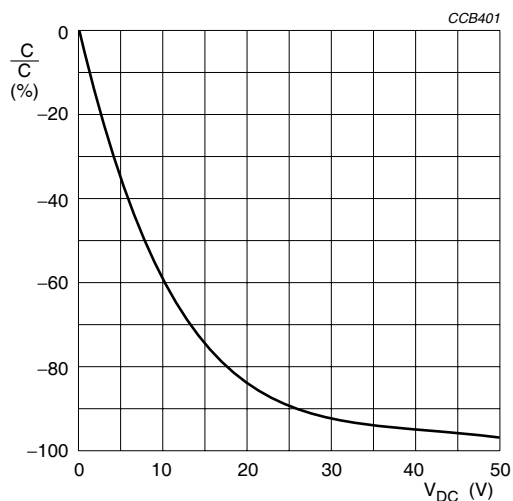
Curve 1 = 16 V product  
Curve 2 = 25 V product  
Curve 3 = 50 V product



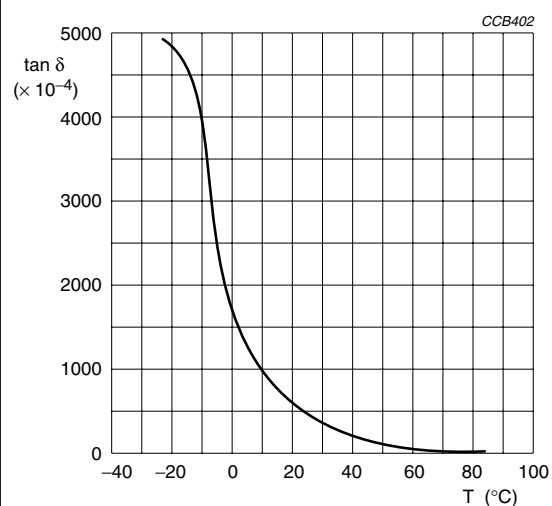
**Fig. 10** Typical tan δ as a function of temperature



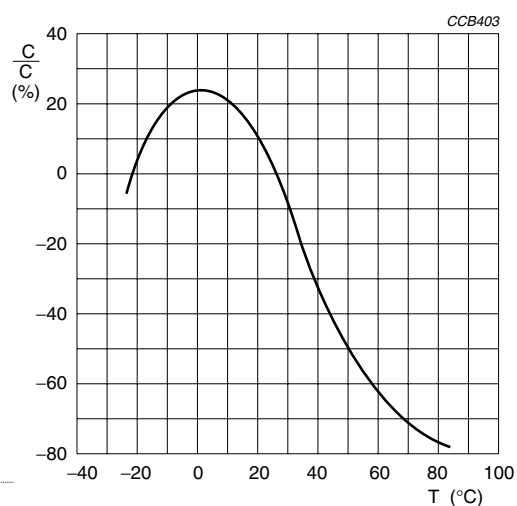
**Fig. 11** Typical capacitance change as a function of temperature

**Y5V 0612 25 V**


**Fig. 12** Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 25 °C



**Fig. 13** Typical tan δ as a function of temperature



**Fig. 14** Typical capacitance change as a function of temperature

**TESTS AND REQUIREMENTS****Table 7** Test procedures and requirements

| TEST                                  | TEST METHOD     | PROCEDURE                                                                                                                                                                                                                                                                                                                                   | REQUIREMENTS                                                                                                                                                      |
|---------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mounting                              | IEC 60384-21/22 | 4.3 The capacitors may be mounted on printed-circuit boards or ceramic substrates                                                                                                                                                                                                                                                           | No visible damage                                                                                                                                                 |
| Visual inspection and dimension check |                 | 4.4 Any applicable method using $\times 10$ magnification                                                                                                                                                                                                                                                                                   | In accordance with specification                                                                                                                                  |
| Capacitance                           |                 | 4.5.1 Class 1:<br>f = 1 MHz for $C \leq 1$ nF, measuring at voltage 1 $V_{rms}$ at 20 °C<br>f = 1 KHz for $C > 1$ nF, measuring at voltage 1 $V_{rms}$ at 20 °C<br>Class 2:<br>f = 1 KHz for $C \leq 10$ $\mu$ F, measuring at voltage 1 $V_{rms}$ at 20 °C<br>f = 120 Hz for $C > 10$ $\mu$ F, measuring at voltage 0.5 $V_{rms}$ at 20 °C | Within specified tolerance                                                                                                                                        |
| Dissipation factor (D.F.)             |                 | 4.5.2 Class 1:<br>f = 1 MHz for $C \leq 1$ nF, measuring at voltage 1 $V_{rms}$ at 20 °C<br>f = 1 KHz for $C > 1$ nF, measuring at voltage 1 $V_{rms}$ at 20 °C<br>Class 2:<br>f = 1 KHz for $C \leq 10$ $\mu$ F, measuring at voltage 1 $V_{rms}$ at 20 °C<br>f = 120 Hz for $C > 10$ $\mu$ F, measuring at voltage 0.5 $V_{rms}$ at 20 °C | In accordance with specification                                                                                                                                  |
| Insulation resistance                 |                 | 4.5.3 At $U_r$ (DC) for 1 minute                                                                                                                                                                                                                                                                                                            | In accordance with specification                                                                                                                                  |
| Temperature coefficient               |                 | 4.6 Class 1:<br>Between minimum and maximum temperature<br>NP0: -55 °C to +125 °C<br>Normal Temperature: 20 °C                                                                                                                                                                                                                              | <General purpose series><br>$\Delta C/C$ :<br>Class 1: NP0: $\pm 30$ ppm/°C                                                                                       |
| Temperature characteristic            |                 | Class 2:<br>Between minimum and maximum temperature<br>X5R: -55 °C to +85 °C<br>X7R: -55 °C to +125 °C<br>Y5V: -30 °C to +85 °C<br>Normal Temperature: 20 °C                                                                                                                                                                                | <General purpose series><br>Class 2: X5R/X7R: $\pm 15\%$<br>Y5V: 22% to -82%<br><br><High Capacitance series><br>Class 2: X5R/X7R: $\pm 15\%$<br>Y5V: 22% to -82% |
| Adhesion                              |                 | 4.7 A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate                                                                                                                                                                                                                            | Force<br>size $\geq$ 0603: 5N<br>size = 0402: 2.5N<br>size = 0201: 1N                                                                                             |

| TEST                                 | TEST METHOD         | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bond strength of plating on end face | IEC 60384-21/22 4.8 | Mounting in accordance with IEC 60384-22 paragraph 4.3<br><br>Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm                                                                                                                                                                                                                                                                                                                                                                                                        | No visible damage<br><br><General purpose series><br>$\Delta C/C$<br>Class 1:<br>NP0: within $\pm 1\%$ or 0.5 pF, whichever is greater<br>Class2:<br>X5R/X7R/Y5V: $\pm 10\%$<br><br><High Capacitance series><br>$\Delta C/C$<br>Class2:<br>X5R/X7R/Y5V: $\pm 10\%$                                                                                                                                                                                                   |
| Resistance to soldering heat         | 4.9                 | Precondition: 150 $\pm 0/-10$ °C for 1 hour, then keep for 24 $\pm 1$ hours at room temperature<br>Preheating: for size $\leq 1206$ : 120 °C to 150 °C for 1 minute<br>Preheating: for size $>1206$ : 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute<br>Solder bath temperature: 260 $\pm 5$ °C<br>Dipping time: 10 $\pm 0.5$ seconds<br>Recovery time: 24 $\pm 2$ hours                                                                                                                                            | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned<br><br><General purpose series><br>$\Delta C/C$<br>Class 1:<br>NP0: within $\pm 0.5\%$ or 0.5 pF, whichever is greater<br>Class2:<br>X5R/X7R: $\pm 10\%$<br>Y5V: $\pm 20\%$<br><br><High Capacitance series><br>$\Delta C/C$<br>Class2:<br>X5R/X7R: $\pm 10\%$<br>Y5V: $\pm 20\%$<br><br>D.F. within initial specified value<br>$R_{ins}$ within initial specified value |
| Solderability                        | 4.10                | Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds.<br><br>Test conditions for lead containing solder alloy<br>Temperature: 235 $\pm 5$ °C<br>Dipping time: 2 $\pm 0.2$ seconds<br>Depth of immersion: 10 mm<br>Alloy Composition: 60/40 Sn/Pb<br>Number of immersions: 1<br><br>Test conditions for leadfree containing solder alloy<br>Temperature: 245 $\pm 5$ °C<br>Dipping time: 3 $\pm 0.3$ seconds<br>Depth of immersion: 10 mm<br>Alloy Composition: SAC305<br>Number of immersions: 1 | The solder should cover over 95% of the critical area of each termination                                                                                                                                                                                                                                                                                                                                                                                             |

| TEST                               | TEST METHOD     | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rapid change of temperature        | IEC 60384-21/22 | 4.11<br>Preconditioning:<br>150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature<br><br>5 cycles with following detail:<br>30 minutes at lower category temperature<br>30 minutes at upper category temperature<br><br>Recovery time 24 ±2 hours                                                                                                                                                                                                                                                                                                                                    | No visual damage<br><br><b>&lt;General purpose series&gt;</b><br>ΔC/C<br>Class 1:<br>NP0: within ±1% or 1 pF, whichever is greater<br>Class2:<br>X5R/X7R: ±15%<br>Y5V: ±20%<br><br><b>&lt;High Capacitance series&gt;</b><br>ΔC/C<br>Class2:<br>X5R/X7R: ±15%<br>Y5V: ±20%<br><br>D.F. meet initial specified value<br>R <sub>ins</sub> meet initial specified value                                                                                                                                                                                                                                                                                                                                                                                            |
| Damp heat with U <sub>r</sub> load | 4.13            | 1. Preconditioning, class 2 only:<br>150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp<br>2. Initial measure:<br>Spec: refer initial spec C, D, IR<br>3. Damp heat test:<br>500 ±12 hours at 40 ±2 °C;<br>90 to 95% R.H. 1.0 U <sub>r</sub> applied<br>4. Recovery:<br>Class 1: 6 to 24 hours<br>Class 2: 24 ±2 hours<br>5. Final measure: C, D, IR<br><br>P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be precondition according to "IEC 60384 4.1" and then the requirement shall be met. | No visual damage after recovery<br><br><b>&lt;General purpose series&gt;</b><br>ΔC/C<br>Class 1:<br>NP0: within ±2% or 1 pF, whichever is greater<br>Class2:<br>X5R/X7R: ±15%; Y5V: ±30%<br>D.F.<br>Class 1: NP0: ≤ 2 × specified value<br>Class2:<br>X5R/X7R: ≤ 16V: ≤ 7%<br>≥ 25V: ≤ 5%<br>Y5V: ≤ 15%<br>R <sub>ins</sub><br>Class 1:<br>NP0: ≥ 2,500 MΩ or R <sub>ins</sub> × C <sub>r</sub> ≥ 25s whichever is less<br>Class2:<br>X5R/X7R/Y5V: ≥ 500 MΩ or R <sub>ins</sub> × C <sub>r</sub> ≥ 25s whichever is less<br><br><b>&lt;High Capacitance series&gt;</b><br>ΔC/C<br>Class2: X5R/X7R: ±20%; Y5V: ±30%<br>D.F.<br>Class2: 2 × initial value max<br>R <sub>ins</sub><br>Class2: 500 MΩ or R <sub>ins</sub> × C <sub>r</sub> ≥ 25s, whichever is less |

| TEST          | TEST METHOD          | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Endurance     | IEC 60384-21/22 4.14 | <p>1. Preconditioning, class 2 only:<br/>150 +0/-10 °C /1 hour, then keep for<br/>24 ±1 hour at room temp</p> <p>2. Initial measure:<br/>Spec: refer initial spec C, D, IR</p> <p>3. Endurance test:<br/>Temperature: NP0/X7R: 125 °C<br/>X5R/Y5V: 85 °C<br/>Specified stress voltage applied for 1,000 hours:<br/>Applied <math>2.0 \times U_r</math> for general product.<br/>Applied <math>1.5 \times U_r</math> for high cap. product.<br/>High voltage series follows with below stress condition:<br/>Applied <math>1.3 \times U_r</math> for 500V series<br/>Applied <math>1.2 \times U_r</math> for 1KV, 2KV, 3KV series</p> <p>4. Recovery time: 24 ±2 hours</p> <p>5. Final measure: C, D, IR</p> <p>P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be precondition according to "IEC 60384 4.1" and then the requirement shall be met.</p> | <p>No visual damage</p> <hr/> <p><b>&lt;General purpose series&gt;</b></p> <p><math>\Delta C/C</math><br/>Class I:<br/>NP0: within ±2% or 1 pF, whichever is greater<br/>Class2:<br/>X5R/X7R: ±15%; Y5V: ±30%</p> <p>D.F.<br/>Class I:<br/>NP0: <math>\leq 2 \times</math> specified value<br/>Class2:<br/>X5R/X7R: <math>\leq 16V: \leq 7\%</math><br/><math>\geq 25V: \leq 5\%</math><br/>Y5V: <math>\leq 15\%</math></p> <p><math>R_{ins}</math><br/>Class I:<br/>NP0: <math>\geq 4,000 M\Omega</math> or<br/><math>R_{ins} \times C_r \geq 40s</math> whichever is less<br/>Class2:<br/>X5R/X7R/Y5V: <math>\geq 1,000 M\Omega</math> or<br/><math>R_{ins} \times C_r \geq 50s</math> whichever is less</p> <p><b>&lt;High Capacitance series&gt;</b></p> <p><math>\Delta C/C</math><br/>Class 2:<br/>X5R/X7R: ±20%; Y5V: ±30%</p> <p>D.F.<br/>Class 2:<br/><math>2 \times</math> initial value max</p> <p><math>R_{ins}</math><br/>Class 2:<br/><math>1,000 M\Omega</math> or <math>R_{ins} \times C_r \geq 50s</math>, whichever is less</p> |
| Voltage proof | IEC 60384-1 4.6      | <p>Specified stress voltage applied for 1 minute</p> <p><math>U_r \leq 100 V</math>: series applied <math>2.5 U_r</math><br/> <math>100 V &lt; U_r \leq 200 V</math> series applied <math>(1.5 U_r + 100)</math><br/> <math>200 V &lt; U_r \leq 500 V</math> series applied <math>(1.3 U_r + 100)</math><br/> <math>U_r &gt; 500 V</math>: <math>1.3 U_r</math></p> <p>I: 7.5 mA</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No breakdown or flashover                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## REVISION HISTORY

| REVISION  | DATE         | CHANGE NOTIFICATION | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------|--------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version 1 | Feb 05, 2010 | -                   | - The statement of "Halogen Free" on the cover added                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Version 0 | Jun 22, 2009 | -                   | <ul style="list-style-type: none"> <li>- New datasheet for 4C-Array series with RoHS compliant</li> <li>- Replace from pdf files: 0508_16V to 50V_1, 0612_16V to 50V_0, C-Array_NP0_50V_0508_7, C-Array_NP0_50V_0612_7, C-Array_X7R_16V_25V_50V_0612_6, C-Array_X7R_16V_0508_5, C-Array_Y5V_25V_0508_0, C-Array_Y5V_25V_0612_5</li> <li>- Define global part number</li> <li>- Description of "Halogen Free compliant" added</li> <li>- Test method and procedure updated</li> </ul> |