

# Multilayer Ceramic Capacitors



## Features:

- A wide selection of sizes is available (0402 to 1812)
- High capacitance in given case size
- Capacitor with lead-free termination (pure Tin)

## Description

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

POE's MLCC is made by NP0, X7R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

## Applications

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.

## External Dimensions

| Size<br>Inches (mm) | L<br>(mm)            | W<br>(mm)           | T (mm)/Symbol       |   | Remark | M <sub>B</sub><br>(mm) |
|---------------------|----------------------|---------------------|---------------------|---|--------|------------------------|
| 0603 (1608)         | 1.6 ±0.1             | 0.8 ±0.1            | 0.8 ±0.07           | S |        | 0.4 ±0.15              |
|                     | 1.6<br>+0.15 / - 0.1 | 0.8<br>+0.15 / -0.1 | 0.8<br>+0.15 / -0.1 | X |        |                        |
| 0805 (2012)         | 2 ±0.15              | 1.25 ±0.1           | 0.6 ±0.1            | A |        | 0.5 ±0.2               |
|                     |                      |                     | 0.8 ±0.1            | B |        |                        |
|                     |                      |                     | 1.25 ±0.1           | D | #      |                        |
| 1206 (3216)         | 3.2 ±0.15            | 1.6 ±0.15           | 0.8 ±0.1            | B |        | 0.6 ±0.2               |
|                     |                      |                     | 0.95 ±0.1           | C |        |                        |
|                     |                      |                     | 1.15 ±0.15          | J |        |                        |
|                     |                      |                     | 1.25 ±0.1           | D | #      |                        |
|                     | 3.2 ±0.2             | 1.6 ±0.2            | 1.6 ±0.2            | G |        |                        |
| 3.2 +0.3 / -0.1     | 1.6 +0.3 / -0.1      | 1.6 +0.3 / -0.1     | P                   |   |        |                        |

# Reflow soldering only is recommended.

Dimensions : Inches (Millimetres)

## General Electrical Data

| Dielectric              | NPO  | X7R                         | Y5V                      |
|-------------------------|--|-----------------------------|--------------------------|
| Size                    | 0603, 0805, 1206   |                             |                          |
| Capacitance range*      | 0.5 pF to 0.039 µF   | 100 pF to 1 µF              | 10 nF to 680 nF          |
| Capacitance tolerance** | Cap ≤ 5 pF: B (±0.1 pF), C (±0.25 pF)<br>5 pF < Cap < 10 pF: C (±0.25 pF), D (±0.5 pF)<br>Cap ≥ 10 pF: F (±1%), G (±2%), J (±5%), K (±10%) | J (±5%), K (±10%), M (±20%) | M (±20%), Z (-20 / +80%) |

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## General Electrical Data

| Dielectric                  | NPO   | X7R                           | Y5V          |
|-----------------------------|---|-------------------------------|--------------|
| Rated voltage (WVDC)        | 16 V, 25 V, 50 V, 100 V   | 10 V, 16 V, 25 V, 50 V, 100 V |              |
| Tan $\delta^*$              | Cap < 30 pF: Q $\geq$ 400+20C<br>Cap $\geq$ 30 pF: Q $\geq$ 1,000             | Note 1                        |              |
| Insulation resistance at Ur | $\geq 10 \Omega$ or R $\times$ C $\geq 500 \Omega \times F$ whichever is less |                               |              |
| Operating temperature       | -55°C to +125°C   |                               | -25 to +85°C |
| Capacitance characteristic  | $\pm 30$ ppm  | $\pm 15\%$                    | +30 / -80%   |
| Termination                 | Ni / Sn (lead-free termination)   |                               |              |

\* Measured at the condition of 30 to 70% related humidity

NPO : Apply  $1 \pm 0.2 V_{rms}$ , 1 MHz  $\pm 10\%$  for Cap  $\leq$  1,000 pF and  $1 \pm 0.2 V_{rms}$ , 1 kHz  $\pm 10\%$  for Cap > 1,000 pF, 25°C at ambient temperature

X7R : Apply  $1 \pm 0.2 V_{rms}$ , 1 kHz  $\pm 10\%$ , at 25°C ambient temperature

Y5V : Apply  $1 \pm 0.2 V_{rms}$ , 1 kHz  $\pm 10\%$ , at 20°C ambient temperature

\*\* Preconditioning for Class II MLCC: Perform a heat treatment at  $150 \pm 10^\circ\text{C}$  for 1 hour, then leave in ambient condition for 24  $\pm 2$  hours before measurement.

### Note 1:

#### X7R

| Rated vol.  | D.F.         | Exception of D.F. |  |
|-------------|--------------|-------------------|--|
| $\geq 50$ V | $\leq 2.5\%$ | $\leq 3\%$        | 0603 $\geq 0.047 \mu\text{F}$ ; 0805 $\geq 0.18 \mu\text{F}$ ,<br>1206 $\geq 0.47 \mu\text{F}$                               |
| 25 V        | $\leq 3.5\%$ | $\leq 5\%$        | 0805 $\geq 1 \mu\text{F}$ ; 1210 $\geq 10 \mu\text{F}$   |
|             |              | $\leq 7\%$        | 0603 $\geq 0.33 \mu\text{F}$   |
|             |              | 10%               | 0402 $\geq 0.1 \mu\text{F}$ ; 0603 $\geq 0.68 \mu\text{F}$   |
| 16 V        | $\leq 3.5\%$ | $\leq 5\%$        | 0402 $\geq 0.033 \mu\text{F}$ ; 0603 $\geq 0.15 \mu\text{F}$ ;<br>0805 $\geq 0.68 \mu\text{F}$ ; 1206 $\geq 2.2 \mu\text{F}$ |
|             |              | $\leq 10\%$       | 1210 $\geq 22 \mu\text{F}$ ; 0603 $\geq 0.68 \mu\text{F}$  |
| 10 V        | $\leq 5.0\%$ | $\leq 10\%$       | 0603 $\geq 0.33 \mu\text{F}$ ; 0805 $\geq 2.2 \mu\text{F}$   |

#### Y5V

| Rated vol.                     | D.F.          | Exception of D.F. |   |
|--------------------------------|---------------|-------------------|---|
| $\geq 50$ V                    | $\leq 5.0\%$  | 7.0%              | 0603 $\geq 0.1 \mu\text{F}$ ; 0805 $\geq 0.47 \mu\text{F}$  |
| 25V                            | $\leq 5.0\%$  | $\leq 7\%$        | 0402 $\geq 0.047 \mu\text{F}$ ; 0603 $\geq 0.1 \mu\text{F}$ ;<br>0805 $\geq 0.33 \mu\text{F}$ ; 1206 $\geq 1 \mu\text{F}$ |
|                                |               | $\leq 9\%$        | 0402 $\geq 0.068 \mu\text{F}$ ; 0603 $\geq 0.47 \mu\text{F}$  |
| 16 V (C < 1 $\mu\text{F}$ )    | $\leq 7.0\%$  | $\leq 9\%$        | 0402 $\geq 0.068 \mu\text{F}$ ; 0603 $\geq 0.68 \mu\text{F}$  |
| 16 V (C $\geq 1 \mu\text{F}$ ) | $\leq 9.0\%$  | $\leq 12.5\%$     | 0805 $\geq 3.3 \mu\text{F}$ ; 1206 $\geq 10 \mu\text{F}$ ;<br>1210 $\geq 22 \mu\text{F}$ ; 1812 $\geq 47 \mu\text{F}$     |
| 10 V                           | $\leq 12.5\%$ |                   | 0402 $\geq 0.47 \mu\text{F}$  |

# Multilayer Ceramic Capacitors



## Capacitance Range (0603)

| Dielectric           | NP0    |        |        | X7R    |        |        | Y5V    |        |        |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Size                 | 0603   |        |        |        |        |        |        |        |        |
| Rated Voltage (V dc) | 16 (V) | 25 (V) | 50 (V) | 16 (V) | 25 (V) | 50 (V) | 16 (V) | 25 (V) | 50 (V) |
| 22 pF (220)          | S      | S      | S      | -      | -      | -      | -      | -      | -      |
| 100 pF (101)         | S      | S      | S      | S      | S      | S      | -      | -      | -      |
| 220 pF (221)         | S      | S      | S      | S      | S      | S      | -      | -      | -      |
| 1,000 pF (102)       | S      | S      | S      | S      | S      | S      | -      | -      | -      |
| 0.1 µF (104)         | -      | -      | -      | S      | S      | S      | S      | S      | S      |
| 220 pF (221)         | S      | S      | S      | S      | S      | S      | -      | -      | -      |
| 470 pF (471)         | S      | S      | S      | S      | S      | S      | -      | -      | -      |
| 0.010 µF (103)       | -      | -      | -      | -      | -      | -      | S      | S      | S      |

1. The letter in cell is expressed the symbol of product thickness.

## Capacitance Range (0805)

| Dielectric           | NP0    |        |         | X7R    |        |         | Y5V    |        |         |
|----------------------|--------|--------|---------|--------|--------|---------|--------|--------|---------|
| Size                 | 0805   |        |         |        |        |         |        |        |         |
| Rated Voltage (V dc) | 16 (V) | 50 (V) | 100 (V) | 16 (V) | 50 (V) | 100 (V) | 16 (V) | 50 (V) | 100 (V) |
| 1,000 pF (102)       | B      | B      | B       | B      | B      | B       | -      | -      | -       |
| 2,200 pF (222)       | B      | B      | B       | B      | B      | B       | -      | -      | -       |
| 0.22 µF (224)        | -      | -      | -       | D      | D      | -       | -      | -      | -       |
| 0.33 µF (334)        | -      | -      | -       | D      | D      | -       | -      | -      | -       |
| 0.47 µF (474)        | -      | -      | -       | D      | D      | -       | -      | -      | -       |
| 100 pF               | -      | -      | -       | B      | B      | B       | -      | -      | -       |
| 220 pF               | A      | A      | A       | B      | B      | B       | -      | -      | -       |
| 470 pF               | -      | -      | -       | B      | B      | B       | -      | -      | -       |
| 0.22 µF (224)        | -      | -      | -       | D      | D      | -       | -      | -      | -       |
| 0.33 µF (334)        | -      | -      | -       | D      | D      | -       | B      | B      | -       |
| 0.47 µF (474)        | -      | -      | -       | D      | D      | -       | B      | B      | -       |
| 0.010 µF (103)       | D      | -      | -       | B      | B      | B       | A      | A      | B       |
| 0.022 µF (223)       | -      | -      | -       | B      | B      | B       | A      | A      | B       |
| 0.047 µF (473)       | -      | -      | -       | B      | B      | D       | -      | -      | -       |
| 0.1 µF (104)         | -      | -      | -       | B      | B      | D       | -      | -      | -       |

1. The letter in cell is expressed the symbol of product thickness.

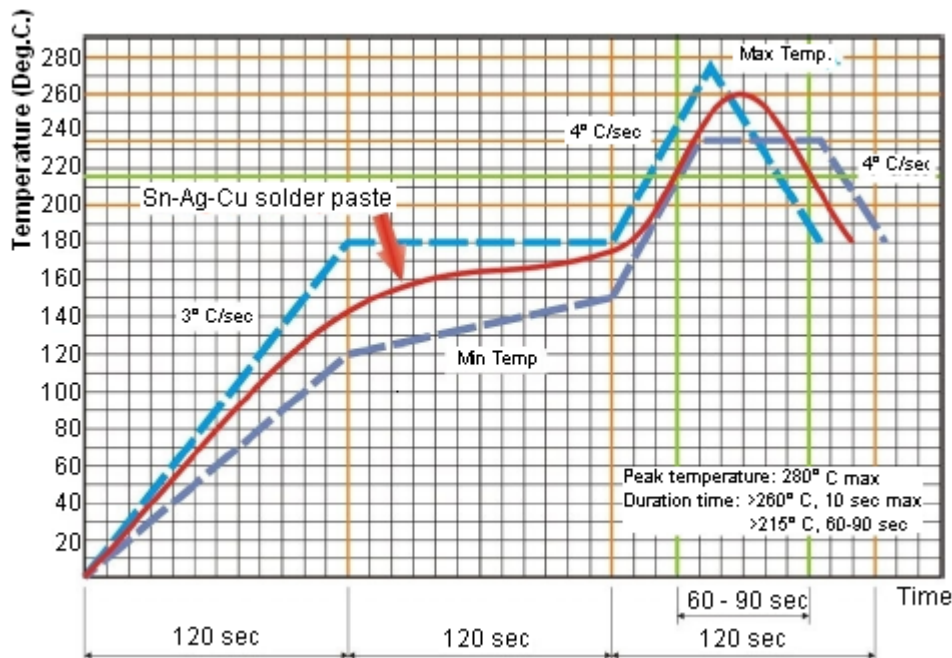
## Capacitance Range (1206)

| Dielectric           | NP0    |        | X7R    |        | Y5V    |        |
|----------------------|--------|--------|--------|--------|--------|--------|
| Size                 | 1206   |        |        |        |        |        |
| Rated Voltage (V dc) | 25 (V) | 50 (V) | 25 (V) | 50 (V) | 25 (V) | 50 (V) |
| 0.33 $\mu$ F         | -      | -      | C      | D      | B      | B      |
| 0.47 $\mu$ F         | -      | -      | J      | P      | B      | B      |
| 10 nF                | -      | -      | -      | -      | -      | -      |
| 100 nF               | -      | -      | -      | -      | -      | -      |

1. The letter in cell is expressed the symbol of product thickness.

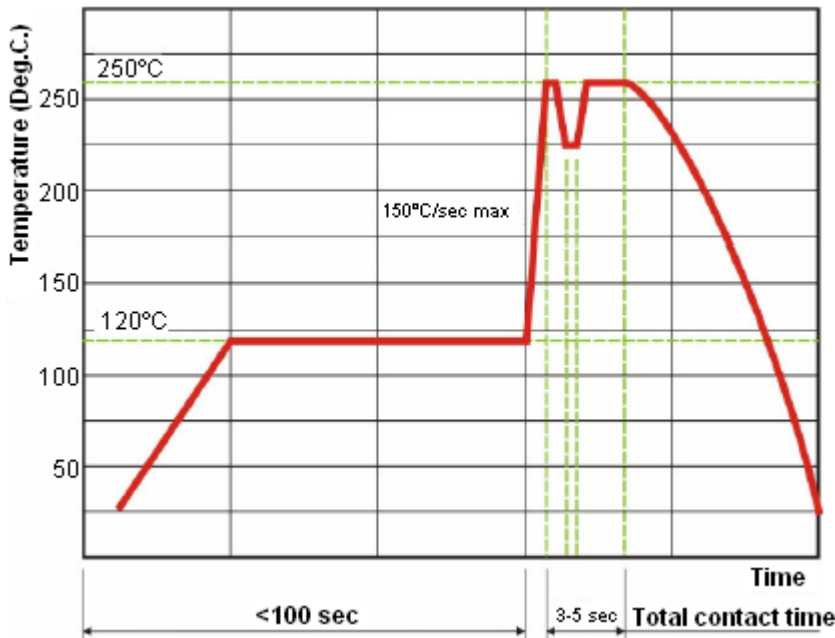
## Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N<sub>2</sub> within oven are recommended.



Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste.

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Recommended wave soldering profile for SMT process with SnAgCu series solder.

## Part Number Explanation:

|               |             |            |             |           |             |           |
|---------------|-------------|------------|-------------|-----------|-------------|-----------|
| <u>U</u>      | <u>0603</u> | <u>C</u>   | <u>220</u>  | <u>J</u>  | <u>C</u>    | <u>T</u>  |
|               |             |            |             |           |             |           |
| Rated Voltage | Size        | Dielectric | Capacitance | Tolerance | Termination | Packaging |

**Rated Voltage** : Two significant digits followed by no. of zeros and R is in place of decimal point)  
 A = 100 V, B = 16 V, T = 25 V and U = 50 V

**Size** : 0603 inches (1608 mm), 0805 inches (2012 mm) and 1206 inches (3216 mm)

**Dielectric** : C = NP0 (C0G), R = X7R and F = Y5V

**Capacitance** : Two significant digits followed by number of zeros and R is in place of decimal point  
 eg: 102 =  $10 \times 10^2 = 1,000 \text{ pF}$

**Tolerance** : B =  $\pm 0.1 \text{ pF}$ , C =  $\pm 0.25 \text{ pF}$ , D =  $\pm 0.5 \text{ pF}$ , F =  $\pm 1\%$ , G =  $+2\%$  and J =  $+5\%$

**Termination** : C = Cu / Ni / Sn

**Packaging** : T = 7 inches reeled

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