

# DATA SHEET

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

General purpose & High capacitance

Class 2, Y5V

6.3 V TO 50 V

10 nF to 47  $\mu$ F

RoHS compliant & Halogen Free



## SCOPE

This specification describes Y5V series chip capacitors with lead-free terminations.

## APPLICATIONS

Consumer electronics, for example:

- Tuners
- Television receivers
- Video recorders
- All types of cameras
- Mobile telephones

## FEATURES

Supplied in tape on reel

Nickel-barrier end termination

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.

### YAGEO BRAND ordering code

### GLOBAL PART NUMBER (PREFERRED)

CC XXXX X X Y5V X BB XXX  
(1) (2) (3) (4) (5)

### (1) SIZE – INCH BASED (METRIC)

0201 (0603)  
0402 (1005)  
0603 (1608)  
0805 (2012)  
1206 (3216)  
1210 (3225)

### (2) TOLERANCE

M =  $\pm 20\%$   
Z =  $-20\%$  to  $+80\%$

### (3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch  
K = Blister taping reel; Reel 7 inch  
P = Paper/PE taping reel; Reel 13 inch  
F = Blister taping reel; Reel 13 inch

### (4) RATED VOLTAGE

5 = 6.3 V  
6 = 10 V  
7 = 16 V  
8 = 25 V  
9 = 50 V

### (5) CAPACITANCE VALUE

2 significant digits+number of zeros  
The 3rd digit signifies the multiplying factor, and letter R is decimal point  
Example: 103 =  $10 \times 10^3 = 10,000 \text{ pF} = 10 \text{ nF}$

## 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. A cross section of the structure is shown in Fig.1.

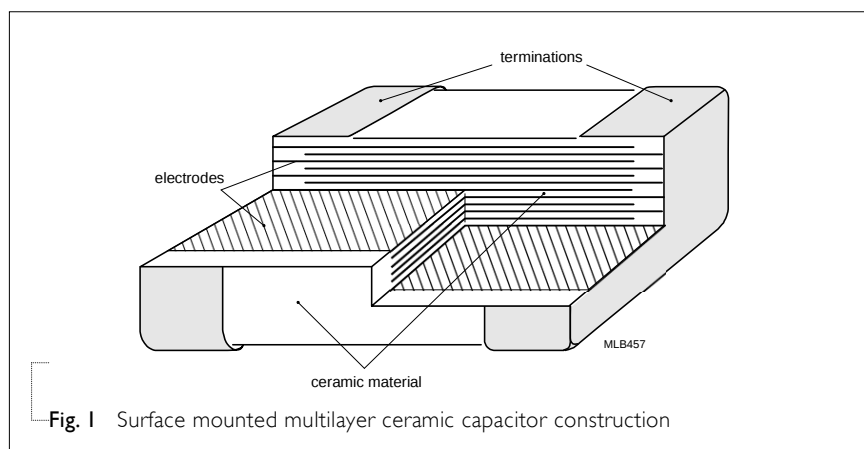


Fig. 1 Surface mounted multilayer ceramic capacitor construction

## DIMENSION

Table I For outlines see fig. 2

| TYPE | L <sub>1</sub> (mm)      | W (mm)                    | T (MM)                   | L <sub>2</sub> / L <sub>3</sub> (mm) |      | L <sub>4</sub> (mm) |
|------|--------------------------|---------------------------|--------------------------|--------------------------------------|------|---------------------|
|      |                          |                           |                          | min.                                 | max. | min.                |
| 0201 | 0.6 ±0.03                | 0.3 ±0.03                 | Refer to<br>table 2 to 4 | 0.10                                 | 0.20 | 0.20                |
| 0402 | 1.0 ±0.05                | 0.5 ±0.05                 |                          | 0.15                                 | 0.35 | 0.30                |
| 0603 | 1.6 ±0.10                | 0.8 ±0.10                 |                          | 0.20                                 | 0.60 | 0.40                |
| 0805 | 2.0 ±0.10 <sup>(1)</sup> | 1.25 ±0.10 <sup>(1)</sup> |                          | 0.25                                 | 0.75 | 0.70                |
|      | 2.0 ±0.20 <sup>(2)</sup> | 1.25 ±0.20 <sup>(2)</sup> |                          |                                      |      |                     |
| 1206 | 3.2 ±0.15 <sup>(1)</sup> | 1.6 ±0.15 <sup>(1)</sup>  |                          | 0.25                                 | 0.75 | 1.40                |
|      | 3.2 ±0.30 <sup>(2)</sup> | 1.6 ±0.20 <sup>(2)</sup>  |                          |                                      |      |                     |
| 1210 | 3.2 ±0.20 <sup>(1)</sup> | 2.5 ±0.20 <sup>(1)</sup>  |                          | 0.25                                 | 0.75 | 1.40                |
|      | 3.2 ±0.40 <sup>(2)</sup> | 2.5 ±0.30 <sup>(2)</sup>  |                          |                                      |      |                     |
| 1812 | 4.5 ±0.20 <sup>(1)</sup> | 3.2 ±0.20 <sup>(1)</sup>  |                          | 0.25                                 | 0.75 | 2.20                |
|      | 4.5 ±0.40 <sup>(2)</sup> | 3.2 ±0.40 <sup>(2)</sup>  |                          |                                      |      |                     |

## NOTE

1. Dimension for size 0805 to 1812, C ≤ 100 nF
2. Dimension for size 0805 to 1812, C > 100 nF

## OUTLINES

For dimension see Table I

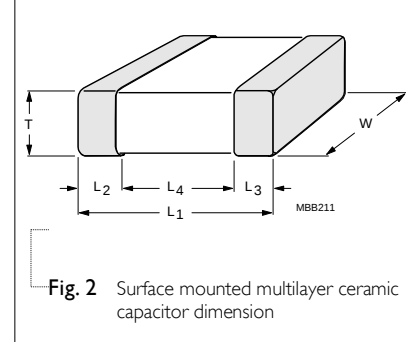


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

**CAPACITANCE RANGE & THICKNESS FOR Y5V****Table 2** Sizes from 0201 to 0402

| CAP.   | 0201<br>6.3 V | 25 V     | 0402<br>6.3 V | 10 V     | 16 V     | 25 V     | 50 V     |
|--------|---------------|----------|---------------|----------|----------|----------|----------|
| 10 nF  |               | 0.3±0.03 |               | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 |
| 22 nF  |               |          |               | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 |          |
| 47 nF  |               |          |               | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 |          |
| 100 nF | 0.3±0.03      |          | 0.5±0.05      | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 |          |
| 220 nF |               |          | 0.5±0.05      | 0.5±0.05 | 0.5±0.05 |          |          |
| 470 nF |               |          | 0.5±0.05      | 0.5±0.05 | 0.5±0.05 |          |          |
| 1.0 µF |               |          | 0.5±0.05      | 0.5±0.05 |          |          |          |
| 2.2 µF |               |          |               |          |          |          |          |
| 4.7 µF |               |          |               |          |          |          |          |
| 10 µF  |               |          |               |          |          |          |          |
| 22 µF  |               |          |               |          |          |          |          |
| 47 µF  |               |          |               |          |          |          |          |

**Table 3** Sizes from 0603 to 0805

| CAP.   | 0603<br>6.3 V | 10 V    | 16 V    | 25 V    | 50 V    | 0805<br>6.3 V | 10 V     | 16 V     | 25 V     | 50 V     |
|--------|---------------|---------|---------|---------|---------|---------------|----------|----------|----------|----------|
| 10 nF  |               |         |         | 0.8±0.1 | 0.8±0.1 |               |          |          | 0.6±0.1  | 0.6±0.1  |
| 22 nF  |               |         |         | 0.8±0.1 | 0.8±0.1 |               |          |          | 0.6±0.1  | 0.6±0.1  |
| 47 nF  |               |         |         | 0.8±0.1 | 0.8±0.1 |               |          |          | 0.6±0.1  | 0.6±0.1  |
| 100 nF |               |         | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |               |          |          | 0.6±0.1  | 0.6±0.1  |
| 220 nF |               |         | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |               |          | 0.6±0.1  | 0.85±0.1 | 0.85±0.1 |
| 470 nF |               |         | 0.8±0.1 | 0.8±0.1 |         |               |          | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 |
| 1.0 µF | 0.8±0.1       | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |         |               |          | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 |
| 2.2 µF | 0.8±0.1       | 0.8±0.1 | 0.8±0.1 |         |         | 0.85±0.1      | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 |          |
| 4.7 µF | 0.8±0.1       | 0.8±0.1 |         |         |         | 0.85±0.1      | 0.85±0.1 | 1.25±0.2 |          |          |
| 10 µF  |               |         |         |         |         | 1.25±0.2      | 1.25±0.2 |          |          |          |
| 22 µF  |               |         |         |         |         | 1.25±0.2      | 1.25±0.2 |          |          |          |
| 47 µF  |               |         |         |         |         |               |          |          |          |          |

**NOTE**

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-3 series is on request

**CAPACITANCE RANGE & THICKNESS FOR Y5V****Table 4** Sizes from 1206 to 1210

| CAP.   | 1206     |          |          |          |          | 1210    |         |         |         |         |
|--------|----------|----------|----------|----------|----------|---------|---------|---------|---------|---------|
|        | 6.3 V    | 10 V     | 16 V     | 25 V     | 50 V     | 6.3 V   | 10 V    | 16 V    | 25 V    | 50V     |
| 10 nF  |          |          |          | 0.6±0.1  | 0.6±0.1  |         |         |         |         |         |
| 22 nF  |          |          |          | 0.6±0.1  | 0.6±0.1  |         |         |         |         |         |
| 47 nF  |          |          |          | 0.6±0.1  | 0.6±0.1  |         |         |         |         |         |
| 100 nF |          |          |          | 0.6±0.1  | 0.6±0.1  |         |         |         |         |         |
| 220 nF |          |          |          | 0.6±0.1  | 0.6±0.1  |         |         |         |         |         |
| 470 nF |          |          |          | 0.85±0.1 | 0.85±0.1 |         |         |         |         |         |
| 1.0 µF |          |          |          | 0.85±0.1 |          |         |         |         |         |         |
| 2.2 µF |          | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 |          |         |         |         |         |         |
| 4.7 µF |          | 0.85±0.1 | 0.85±0.1 |          |          |         |         |         |         |         |
| 10 µF  | 0.85±0.1 | 0.85±0.1 | 1.15±0.1 | 1.6±0.2  |          | 1.5±0.1 | 1.5±0.1 | 1.5±0.1 | 1.5±0.1 | 1.5±0.1 |
| 22 µF  | 1.6±0.2  | 1.6±0.2  | 1.6±0.2  |          |          | 1.6±0.2 | 1.6±0.2 | 1.6±0.2 |         |         |
| 47 µF  |          |          |          |          |          |         |         |         |         |         |

**NOTE**

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-3 series is on request

## THICKNESS CLASSES AND PACKING QUANTITY

Table 5

| SIZE CODE | THICKNESS CLASSIFICATION | TAPE WIDTH<br>QUANTITY PER REEL | Ø180 MM / 7 INCH |                | Ø330 MM / 13 INCH |         | QUANTITY<br>PER BULK CASE |
|-----------|--------------------------|---------------------------------|------------------|----------------|-------------------|---------|---------------------------|
|           |                          |                                 | Paper            | Blister        | Paper             | Blister |                           |
| 0201      | 0.3 ±0.03 mm             | 8 mm                            | 15,000           | ---            | 50,000            | ---     | ---                       |
| 0402      | 0.5 ±0.05 mm             | 8 mm                            | 10,000           | ---            | 50,000            | ---     | 50,000                    |
| 0603      | 0.8 ±0.1 mm              | 8 mm                            | 4,000            | ---            | 15,000            | ---     | 15,000                    |
| 0805      | 0.6 ±0.1 mm              | 8 mm                            | 4,000            | ---            | 20,000            | ---     | 10,000                    |
|           | 0.85 ±0.1 mm             | 8 mm                            | 4,000            | ---            | 15,000            | ---     | 8,000                     |
|           | 1.25 ±0.2 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | 5,000                     |
| 1206      | 0.6 ±0.1 mm              | 8 mm                            | 4,000            | ---            | 20,000            | ---     | ---                       |
|           | 0.85 ±0.1 mm             | 8 mm                            | 4,000            | ---            | 15,000            | ---     | ---                       |
|           | 1.00 / 1.15 ±0.1 mm      | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                       |
|           | 1.25 ±0.2 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                       |
|           | 1.6 ±0.15 mm             | 8 mm                            | ---              | 2,500          | ---               | 10,000  | ---                       |
|           | 1.6 ±0.2 mm              | 8 mm                            | ---              | 2,000          | ---               | 10,000  | ---                       |
| 1210      | 0.6 / 0.7 ±0.1 mm        | 8 mm                            | ---              | 4,000          | ---               | 15,000  | ---                       |
|           | 0.85 ±0.1 mm             | 8 mm                            | ---              | 4,000          | ---               | 10,000  | ---                       |
|           | 1.15 ±0.1 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                       |
|           | 1.15 ±0.15 mm            | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                       |
|           | 1.25 ±0.2 mm             | 8 mm                            | ---              | 3,000          | ---               | ---     | ---                       |
|           | 1.5 ±0.1 mm              | 8 mm                            | ---              | 2,000          | ---               | ---     | ---                       |
|           | 1.6 / 1.9 ±0.2 mm        | 8 mm                            | ---              | 2,000          | ---               | ---     | ---                       |
|           | 2.0 ±0.2 mm              | 8 mm                            | ---              | 2,000<br>1,000 | ---               | ---     | ---                       |
|           | 2.5 ±0.2 mm              | 8 mm                            | ---              | 1,000<br>500   | ---               | ---     | ---                       |

ELECTRICAL CHARACTERISTICS**Y5V DIELECTRIC CAPACITORS; NISN TERMINATIONS**

Unless otherwise specified, all test and measurements shall be made under standard atmospheric conditions for testing as given in 5.3 of IEC 60068-1:

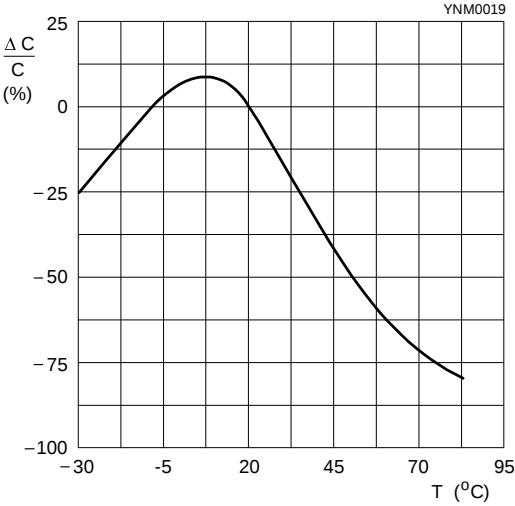
- Temperature: 15 °C to 35 °C
- Relative humidity: 25% to 75%
- Air pressure: 86 kPa to 106 kPa

Before the measurements are made, the capacitor shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature.

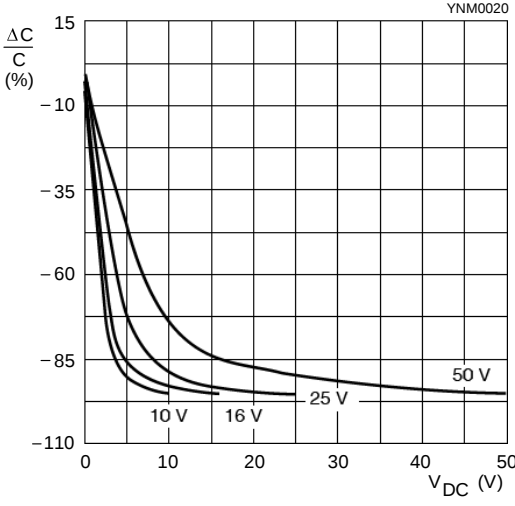
The period as prescribed for recovery at the end of a test is normally sufficient for this purpose.

Table 6

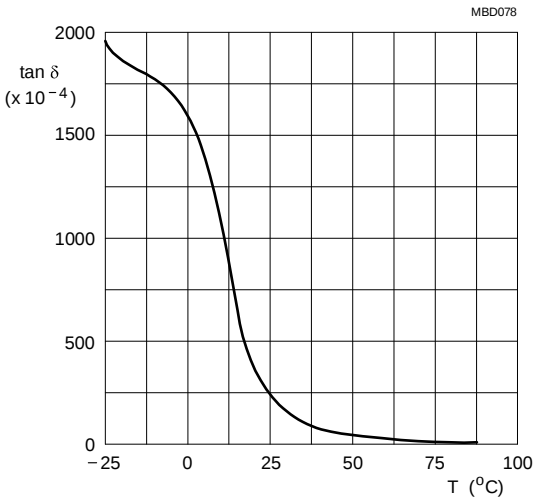
| DESCRIPTION                                                                                       | VALUE                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Capacitance range                                                                                 | 10 nF to 22 $\mu$ F                                                                                                                                                                                                                                                                     |
| Capacitance tolerance                                                                             | $\pm 20\%$<br>-20% to +80%                                                                                                                                                                                                                                                              |
| Dissipation factor (D.F.) $\leq 6.3$ V                                                            | $\leq 15\%$                                                                                                                                                                                                                                                                             |
| Exception: 0805 $\geq 22$ $\mu$ F                                                                 | $\leq 20\%$                                                                                                                                                                                                                                                                             |
| 10 V                                                                                              | $\leq 12.5\%$                                                                                                                                                                                                                                                                           |
| Exception: 0402 $\geq 680$ nF; 0603 $\geq 2.2$ $\mu$ F;                                           | $\leq 15\%$                                                                                                                                                                                                                                                                             |
| 0805 $\geq 10$ $\mu$ F; 1206 $\geq 10$ $\mu$ F                                                    | $\leq 20\%$                                                                                                                                                                                                                                                                             |
| 16 V                                                                                              | $\leq 12.5\%$                                                                                                                                                                                                                                                                           |
| Exception: 0603 $\geq 4.7$ $\mu$ F                                                                | $\leq 15\%$                                                                                                                                                                                                                                                                             |
| 1206 $\geq 10$ $\mu$ F                                                                            | $\leq 20\%$                                                                                                                                                                                                                                                                             |
| $\geq 25$ V                                                                                       | $\leq 9\%$                                                                                                                                                                                                                                                                              |
| Exception: 0201 $\geq 10$ nF                                                                      | $\leq 12.5\%$                                                                                                                                                                                                                                                                           |
| Insulation resistance after 1 minute at $U_r$ (DC)                                                | $R_{ins} \geq 10$ G $\Omega$ or $R_{ins} \times C_r \geq 500$ $\Omega \cdot F$ whichever is less<br>$R_{ins} \times C_r \geq 100$ $\Omega \cdot F$ : 0603, 4.7 $\mu$ F, 6.3V and 10V; 0805, 22 $\mu$ F, 10V;<br>$R_{ins} \times C_r \geq 50$ $\Omega \cdot F$ : 0805, 22 $\mu$ F, 6.3V; |
| Maximum capacitance change as a function of temperature (temperature characteristic/coefficient): | +22% to -82%                                                                                                                                                                                                                                                                            |
| Operating temperature range:                                                                      | -30 °C to +85 °C                                                                                                                                                                                                                                                                        |



**Fig. 3** Typical capacitance change as a function of temperature



**Fig. 4** Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C



**Fig. 5** Typical  $\tan \delta$  as a function of temperature

### SOLDERING RECOMMENDATION

| Table 7          |             |          |                     |                     |                     |             |
|------------------|-------------|----------|---------------------|---------------------|---------------------|-------------|
| SOLDERING METHOD | SIZE        |          |                     |                     |                     |             |
|                  | 0201        | 0402     | 0603                | 0805                | 1206                | ≥ 1210      |
| Reflow           | Reflow only | > 100 nF | > 1.0 $\mu\text{F}$ | > 2.2 $\mu\text{F}$ | > 2.2 $\mu\text{F}$ | Reflow only |
| Reflow/Wave      |             | ≤ 100 nF | ≤ 1.0 $\mu\text{F}$ | ≤ 2.2 $\mu\text{F}$ | ≤ 2.2 $\mu\text{F}$ | ---         |

## TESTS AND REQUIREMENTS

Table 8 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 <sup>(1)</sup>               | 4.5.1               | Class 2:<br>At 20 °C, 24 hrs after annealing<br>$f = 1 \text{ KHz}$ for $C \leq 10 \mu\text{F}$ , rated voltage $> 6.3 \text{ V}$ , measuring at voltage $1 V_{\text{rms}}$ at 20 °C<br>$f = 1 \text{ KHz}$ , for $C \leq 10 \mu\text{F}$ , rated voltage $\leq 6.3 \text{ V}$ , measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C<br>$f = 120 \text{ Hz}$ for $C > 10 \mu\text{F}$ , measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C | Within specified tolerance                                                                                                                                |
| Dissipation factor (D.F.) <sup>(1)</sup> | 4.5.2               | Class 2:<br>At 20 °C, 24 hrs after annealing<br>$f = 1 \text{ KHz}$ for $C \leq 10 \mu\text{F}$ , rated voltage $> 6.3 \text{ V}$ , measuring at voltage $1 V_{\text{rms}}$ at 20 °C<br>$f = 1 \text{ KHz}$ , for $C \leq 10 \mu\text{F}$ , rated voltage $\leq 6.3 \text{ V}$ , measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C<br>$f = 120 \text{ Hz}$ for $C > 10 \mu\text{F}$ , measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C | In accordance with specification                                                                                                                          |
| Insulation resistance                    | 4.5.3               | At $U_r$ (DC) for 1 minute                                                                                                                                                                                                                                                                                                                                                                                                                | In accordance with specification                                                                                                                          |
| Temperature characteristic               | 4.6                 | Class 2:<br>Between minimum and maximum temperature<br>Y5V: -30 °C to +85 °C<br>Normal Temperature: 20 °C                                                                                                                                                                                                                                                                                                                                 | <General purpose series><br>$\Delta C/C$<br>Class 2:<br>Y5V: 22% to -82%<br><br><High Capacitance series><br>$\Delta C/C$<br>Class 2:<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                                                                                    |

## NOTE:

1. For individual product specification, please contact local sales.

| TEST                         | TEST METHOD     | PROCEDURE                                                                                                                                                                                                                                                                             | REQUIREMENTS                                                                                                                                                                                                                     |
|------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bending strength             | IEC 60384-21/22 | 4.8 Mounting in accordance with IEC 60384-22 paragraph 4.3                                                                                                                                                                                                                            | No visible damage                                                                                                                                                                                                                |
|                              |                 | Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 5 mm                                                                                                                                                                                                                         | <p>&lt;General purpose series&gt;<br/> <math>\Delta C/C</math><br/> Class2:<br/> Y5V: <math>\pm 10\%</math></p> <p>&lt;High Capacitance series&gt;<br/> <math>\Delta C/C</math><br/> Class2:<br/> Y5V: <math>\pm 10\%</math></p> |
| 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                                                                                                                                                                                       | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned                                                                                                                                     |
|                              |                 | 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 | <p>&lt;General purpose series&gt;<br/> <math>\Delta C/C</math><br/> Class2:<br/> Y5V: <math>\pm 20\%</math></p> <p>&lt;High Capacitance series&gt;<br/> <math>\Delta C/C</math><br/> Class2:<br/> Y5V: <math>\pm 20\%</math></p> |
| Solderability                | 4.10            | Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds.                                                                                                                                                                                             | The solder should cover over 95% of the critical area of each termination                                                                                                                                                        |
|                              |                 | 1. Temperature: 235 $\pm 5$ °C / Dipping time: 2 $\pm 0.5$ s<br>2. Temperature: 245 $\pm 5$ °C / Dipping time: 3 $\pm 0.5$ s (lead free)<br>Depth of immersion: 10mm                                                                                                                  | D.F. within initial specified value<br>R <sub>ins</sub> within initial specified value                                                                                                                                           |

| TEST                        | TEST METHOD     | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rapid change of temperature | IEC 60384-21/22 | <p>4.11</p> <p>Preconditioning:<br/>150 +0/-10 °C for 1 hour; then keep for<br/>24 ± 1 hours at room temperature</p> <p>5 cycles with following detail:<br/>30 minutes at lower category temperature<br/>30 minutes at upper category temperature</p> <p>Recovery time 24 ± 2 hours</p>                                                                                                                                                                                                                                                                                                                             | <p>No visual damage</p> <hr/> <p>&lt;General purpose series&gt;<br/> <math>\Delta C/C</math><br/>           Class2:<br/>           Y5V: ±20%</p> <p>&lt;High Capacitance series&gt;<br/> <math>\Delta C/C</math><br/>           Class2:<br/>           Y5V: ±20%</p> <hr/> <p>D.F. meet initial specified value<br/> <math>R_{ins}</math> meet initial specified value</p>                                                                                                                                                                                                                                                                                                                                                                                       |
| Damp heat with $U_r$ load   | 4.13            | <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. Damp heat test:<br/>500 ± 12 hours at 40 ± 2 °C;<br/>90 to 95% R.H. 1.0 <math>U_r</math> applied</p> <p>4. Recovery:<br/>Class 2: 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 after recovery</p> <hr/> <p>&lt;General purpose series&gt;<br/> <math>\Delta C/C</math><br/>           Class2:<br/>           Y5V: ±30%<br/>           D.F.<br/>           Class2:<br/>           Y5V: ≤ 15%<br/> <math>R_{ins}</math><br/>           Class2:<br/>           Y5V: ≥ 500 MΩ or <math>R_{ins} \times C_r \geq 25s</math><br/>           whichever is less</p> <p>&lt;High Capacitance series&gt;<br/> <math>\Delta C/C</math><br/>           Class2:<br/>           Y5V: ±30%<br/>           D.F.<br/>           Class2:<br/>           Y5V: 2 × initial value max<br/> <math>R_{ins}</math><br/>           Class2:<br/>           Y5V: 500 MΩ or <math>R_{ins} \times C_r \geq 5s</math><br/>           whichever is less</p> |

| 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: Y5V: 85 °C<br/>Specified stress voltage applied for 1,000 hours:<br/>Applied 2.0 × U<sub>r</sub> for general product.<br/>Applied 1.5 × U<sub>r</sub> for high cap. product.</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>&lt;General purpose series&gt;<br/>ΔC/C<br/>Class2:<br/>Y5V: ±30%<br/>D.F.<br/>Class2:<br/>Y5V: ≤ 15%<br/>R<sub>ins</sub><br/>Class2:<br/>Y5V: ≥ 1,000 MΩ or R<sub>ins</sub> × C<sub>r</sub> ≥ 50s<br/>whichever is less</p> <p>&lt;High Capacitance series&gt;<br/>ΔC/C<br/>Class 2:<br/>Y5V: ±30%<br/>D.F.<br/>Class 2:<br/>Y5V: 2 × initial value max<br/>R<sub>ins</sub><br/>Class 2:<br/>Y5V: 1,000 MΩ or R<sub>ins</sub> × C<sub>r</sub> ≥ 10s<br/>whichever is less</p> |
| Voltage proof | IEC 60384-1 4.6      | <p>Specified stress voltage applied for 1~5 seconds<br/>U<sub>r</sub> ≤ 100 V: series applied 2.5 U<sub>r</sub><br/>Charge/Discharge current is less than 50 mA</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No breakdown or flashover                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

REVISION HISTORY

| REVISION   | DATE          | CHANGE NOTIFICATION | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------|---------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version 12 | Dec. 14, 2022 | -                   | - Add 0603, 220nF, 50V                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Version 11 | Oct. 05, 2021 | -                   | - Update 0805, 1210 I.R. spec, modify 0402 L4 spec                                                                                                                                                                                                                                                                                                                                                                                                         |
| Version 10 | Apr. 29, 2021 | -                   | - Update 1206 $\geq 10 \mu\text{F}$ , 16V Df value                                                                                                                                                                                                                                                                                                                                                                                                         |
| Version 9  | Nov. 11, 2019 | -                   | - Add 0603, 4.7uF, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Version 8  | Mar. 7, 2017  | -                   | - 0805 L4 spec updated                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Version 7  | Dec. 9, 2016  | -                   | - Soldering recommendation update                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Version 6  | Jan. 12, 2016 | -                   | - Update capacitance range & thickness                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Version 5  | Jul. 29, 2010 | -                   | - Modify the last 2-digit of 12NC                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Version 4  | Jun. 24, 2010 | -                   | - Dimension on 1206 case size updated                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Version 3  | Apr. 22, 2010 | -                   | - Dimension updated                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Version 2  | Feb. 04, 2010 | -                   | - The statement of "Halogen Free" on the cover added                                                                                                                                                                                                                                                                                                                                                                                                       |
| Version 1  | Nov. 04, 2009 | -                   | - Ordering code updated<br>- Dimension updated                                                                                                                                                                                                                                                                                                                                                                                                             |
| Version 0  | Apr. 15, 2009 | -                   | - New datasheet for general purpose and high capacitance Y5V series with RoHS compliant<br>- Replace the "6.3V to 50V" part of pdf files: Y5V_6.3V_10V_9_Preliminary, Y5V_10V-to-50V_10_Preliminary, Y5V_16V_25V_50V_11<br>- Combine 0201 from pdf files: UP-NP0X5RX7RY5V_0201_6.3-to-50V_2 and UY-NP0X5RX7RY5V_0201_6.3-to-50V_2<br>- Define global part number<br>- Description of "Halogen Free compliant" added<br>- Test method and procedure updated |