

# APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination Series (SH Series)

NP0, X7R, X5R & Y5V Dielectrics

0402 to 1812 Sizes, 6.3V to 100V

RoHS Compliance

\*Contents in this sheet are subject to change without prior notice.

## 1. INTRODUCTION

WTC soft termination series MLCC is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.

## 2. FEATURES

- a. MLCC's termination are with a soft & flexible polymer layer to withstand high bending stress in SMT line.
- b. Available for any item in standard series range.

## 3. APPLICATIONS

- a. Automotive industry.
- b. Power supply and related industries.
- c. Lighting industry.
- d. The other mechanical stress concerned products.

## 4. HOW TO ORDER

| <b>SH</b>           | <b>31</b>             | <b>B</b>           | <b>104</b>                                       | <b>K</b>         | <b>500</b>                                       | <b>C</b>                   | <b>I</b>            |
|---------------------|-----------------------|--------------------|--------------------------------------------------|------------------|--------------------------------------------------|----------------------------|---------------------|
| <u>Series</u>       | <u>Size</u>           | <u>Dielectric</u>  | <u>Capacitance</u>                               | <u>Tolerance</u> | <u>Rated voltage</u>                             | <u>Termination</u>         | <u>Packaging</u>    |
| SH=Soft termination | <b>15=0402 (1005)</b> | <b>N=NP0 (C0G)</b> | Two significant digits followed by no. of zeros. | <b>B=±0.1pF</b>  | Two significant digits followed by no. of zeros. | <b>C=Cu/Polymer /Ni/Sn</b> | <b>T=7" reeled</b>  |
|                     | <b>18=0603 (1608)</b> | <b>B=X7R</b>       | And R is in place of decimal point.              | <b>C=±0.25pF</b> | And R is in place of decimal point.              |                            | <b>G=13" reeled</b> |
|                     | <b>21=0805 (2012)</b> | <b>X=X5R</b>       | Eg.                                              | <b>D=±0.5pF</b>  |                                                  |                            |                     |
|                     | <b>31=1206 (3216)</b> | <b>F=Y5V</b>       | $104=10 \times 10^4$<br>$=100nF$                 | <b>F=±1%</b>     | <b>6R3=6.3 VDC</b>                               |                            |                     |
|                     | <b>32=1210 (3225)</b> |                    |                                                  | <b>G=±2%</b>     | <b>100=10 VDC</b>                                |                            |                     |
|                     | <b>43=1812 (4532)</b> |                    |                                                  | <b>J=±5%</b>     | <b>Z=-20/+80%</b>                                | <b>160=16 VDC</b>          |                     |
|                     |                       |                    |                                                  | <b>K=±10%</b>    |                                                  | <b>250=25 VDC</b>          |                     |
|                     |                       |                    |                                                  | <b>M=±20%</b>    |                                                  | <b>500=50 VDC</b>          |                     |
|                     |                       |                    |                                                  |                  |                                                  | <b>101=100 VDC</b>         |                     |

Note 1: Please see below product range to find right termination code.

## 5. EXTERNAL DIMENSIONS & CONSTRUCTIONS

| Size<br>Inch (mm) | L (mm)              | W (mm)              | T (mm)/Symbol         | Remark | M <sub>B</sub> (mm) |
|-------------------|---------------------|---------------------|-----------------------|--------|---------------------|
| 0402 (1005)       | 1.00±0.20           | 0.50±0.20           | 0.50±0.20 E           |        | 0.25<br>+0.05/-0.10 |
| 0603 (1608)       | 1.60±0.20           | 0.80±0.10           | 0.80±0.07 S           |        | 0.40±0.15           |
|                   | 1.60<br>+0.20/-0.10 | 0.80<br>+0.15/-0.10 | 0.80<br>+0.15/-0.10 X |        |                     |
| 0805 (2012)       | 2.00±0.20           | 1.25±0.10           | 0.60±0.10 A           |        | 0.50±0.20           |
|                   |                     |                     | 0.80±0.10 B           |        |                     |
|                   |                     |                     | 1.25±0.10 D           | #      |                     |
|                   | 2.00±0.25/-0.2      | 1.25±0.20           | 1.25±0.20 I           | #      |                     |
| 1206 (3216)       | 3.20±0.4/-0.1       | 1.60±0.15           | 0.80±0.10 B           |        | 0.60±0.20           |
|                   |                     |                     | 0.95±0.10 C           | #      |                     |
|                   |                     |                     | 1.15±0.15 J           | #      |                     |
|                   |                     |                     | 1.25±0.10 D           | #      |                     |
|                   | 3.20±0.4/-0.1       | 1.60±0.20           | 1.60±0.20 G           | #      |                     |
|                   | 3.20±0.4/-0.1       | 1.60±0.3/0.1        | 1.60±0.30/-0.10 P     | #      |                     |
| 1210 (3225)       | 3.20±0.40           | 2.50±0.20           | 0.95±0.10 C           | #      | 0.75±0.25           |
|                   |                     |                     | 1.25±0.10 D           | #      |                     |
|                   | 3.20±0.50           | 2.50±0.30           | 1.60±0.20 G           | #      | 0.75±0.25           |
|                   |                     |                     | 2.00±0.20 K           | #      |                     |
|                   |                     |                     | 2.50±0.30 M           | #      |                     |
| 1812 (4532)       | 4.50±0.6/-0.4       | 3.20±0.30           | 1.25±0.10 D           | #      | 0.75±0.25           |
|                   |                     |                     | 2.00±0.20 K           | #      |                     |
|                   |                     |                     | 2.50±0.30 M           | #      |                     |

# Reflow soldering only is recommended.

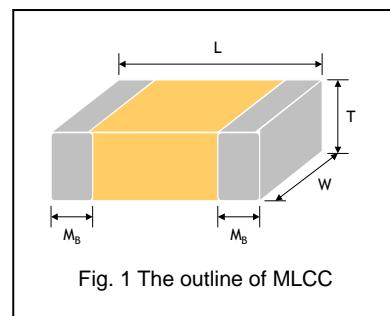


Fig. 1 The outline of MLCC

## 6. GENERAL ELECTRICAL DATA

| Dielectric                        | NP0                                                                                                                                    | X7R                | X5R             | Y5V             |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|-----------------|
| <b>Size</b>                       | 0402, 0603, 0805, 1206, 1210, 1812                                                                                                     |                    |                 |                 |
| <b>Capacitance range*</b>         | 0.1pF to 0.015μF                                                                                                                       | 100pF to 10μF      | 0.027μF to 10μF | 0.01μF to 4.7μF |
| <b>Capacitance tolerance**</b>    | Cap≤5pF:<br>B (±0.1pF), C (±0.25pF)<br>5pF<Cap<10pF:<br>C (±0.25pF), D (±0.5pF)<br>Cap≥10pF:<br>F (±1%), G (±2%),<br>J (±5%), K (±10%) | K (±10%), M (±20%) |                 | Z (-20/+80%)    |
| <b>Rated voltage (WVDC)</b>       | 6.3V, 10V, 16V, 25V, 50V, 100V                                                                                                         |                    |                 |                 |
| <b>Operating temperature</b>      | -55 to +125°C                                                                                                                          | -55 to +125°C      | -55 to +85°C    | -25 to +85°C    |
| <b>Capacitance characteristic</b> | ±30ppm                                                                                                                                 | ±15%               | ±15%            | +30/-80%        |
| <b>Termination</b>                | Ni/Sn (lead-free termination)                                                                                                          |                    |                 |                 |

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

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature  
X7R, X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

\*\* Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

## 7. CAPACITANCE RANGE (NP0 Dielectric )

0402, 0603, 0805 Sizes

| DIELECTRIC    |               | NP0  |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|---------------|---------------|------|----|----|----|-----|------|----|----|----|-----|------|----|----|----|-----|
| SIZE          |               | 0402 |    |    |    |     | 0603 |    |    |    |     | 0805 |    |    |    |     |
| RATED VOLTAGE |               | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 |
| Capacitance   | 0.1pF (0R1)   | E    | E  | E  | E  |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.2pF (0R2)   | E    | E  | E  | E  |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.3pF (0R3)   | E    | E  | E  | E  |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.4pF (0R4)   | E    | E  | E  | E  |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.5pF (0R5)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 0.6pF (0R6)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 0.7pF (0R7)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 0.8pF (0R8)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 0.9pF (0R9)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 1.0pF (1R0)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 1.2pF (1R2)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 1.5pF (1R5)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 1.8pF (1R8)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 2.2pF (2R2)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 2.7pF (2R7)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 3.3pF (3R3)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 3.9pF (3R9)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 4.7pF (4R7)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 5.6pF (5R6)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 6.8pF (6R8)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 8.2pF (8R2)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 10pF (100)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 12pF (120)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 15pF (150)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 18pF (180)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 22pF (220)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 27pF (270)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 33pF (330)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 39pF (390)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 47pF (470)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 56pF (560)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 68pF (680)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 82pF (820)    | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 100pF (101)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 120pF (121)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 150pF (151)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 180pF (181)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 220pF (221)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 270pF (271)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 330pF (331)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | A    | A  | A  | A  | A   |
|               | 390pF (391)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | B    | B  | B  | B  | B   |
|               | 470pF (471)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | B    | B  | B  | B  | B   |
|               | 560pF (561)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | B    | B  | B  | B  | B   |
|               | 680pF (681)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | B    | B  | B  | B  | B   |
|               | 820pF (821)   | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | B    | B  | B  | B  | B   |
|               | 1,000pF (102) | E    | E  | E  | E  | S   | S    | S  | S  | S  | S   | B    | B  | B  | B  | B   |
|               | 1,200pF (122) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 1,500pF (152) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 1,800pF (182) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 2,200pF (222) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 2,700pF (272) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 3,300pF (332) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 3,900pF (392) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 4,700pF (472) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 5,600pF (562) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 6,800pF (682) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 8,200pF (822) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.010uF (103) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.012uF (123) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

1206, 1210, 1812 Sizes

| DIELECTRIC    |               | NP0  |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|---------------|---------------|------|----|----|----|-----|------|----|----|----|-----|------|----|----|----|-----|
| SIZE          |               | 1206 |    |    |    |     | 1210 |    |    |    |     | 1812 |    |    |    |     |
| RATED VOLTAGE |               | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 |
| Capacitance   | 1.0pF (1R0)   |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 1.2pF (1R2)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 1.5pF (1R5)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 1.8pF (1R8)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 2.2pF (2R2)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 2.7pF (2R7)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 3.3pF (3R3)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 3.9pF (3R9)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 4.7pF (4R7)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 5.6pF (5R6)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 6.8pF (6R8)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 8.2pF (8R2)   | B    | B  | B  | B  | B   |      |    |    |    |     |      |    |    |    |     |
|               | 10pF (100)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 12pF (120)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 15pF (150)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 18pF (180)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 22pF (220)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 27pF (270)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 33pF (330)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 39pF (390)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 47pF (470)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 56pF (560)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 68pF (680)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 82pF (820)    | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 100pF (101)   | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 120pF (121)   | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 150pF (151)   | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 180pF (181)   | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 220pF (221)   | B    | B  | B  | B  | B   | C    | C  | C  | C  | C   | D    | D  | D  | D  | D   |
|               | 270pF (271)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 330pF (331)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 390pF (391)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 470pF (471)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 560pF (561)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 680pF (681)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 820pF (821)   |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 1,000pF (102) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 1,200pF (122) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 1,500pF (152) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 1,800pF (182) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 2,200pF (222) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 2,700pF (272) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 3,300pF (332) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 3,900pF (392) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 4,700pF (472) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 5,600pF (562) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 6,800pF (682) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 8,200pF (822) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 0.010μF (103) |      |    |    |    |     | C    | C  | C  | C  | C   |      |    |    |    |     |
|               | 0.012μF (123) |      |    |    |    |     | D    | D  | D  | D  | D   |      |    |    |    |     |
|               | 0.015μF (153) |      |    |    |    |     | D    | D  | D  | D  | D   |      |    |    |    |     |
|               | 0.018μF (183) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.022μF (223) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.027μF (273) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.033μF (333) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|               | 0.039μF (393) |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 7-1. CAPACITANCE RANGE (X7R Dielectric)

0402, 0603, 0805 Sizes

| Capacitance | DIELECTRIC    | X7R  |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|-------------|---------------|------|----|----|----|-----|------|----|----|----|-----|------|----|----|----|-----|
|             | SIZE          | 0402 |    |    |    |     | 0603 |    |    |    |     | 0805 |    |    |    |     |
|             | RATED VOLTAGE | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 |
|             | 100pF (101)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 120pF (121)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 150pF (151)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 180pF (181)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 220pF (221)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 270pF (271)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 330pF (331)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 390pF (391)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 470pF (471)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 560pF (561)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 680pF (681)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 820pF (821)   | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 1,000pF (102) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 1,200pF (122) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 1,500pF (152) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 1,800pF (182) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 2,200pF (222) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 2,700pF (272) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 3,300pF (332) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 3,900pF (392) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 4,700pF (472) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 5,600pF (562) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 6,800pF (682) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 8,200pF (822) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 0.010μF (103) | E    | E  | E  | E  |     | S    | S  | S  | S  | S   | D    | D  | D  | D  | D   |
|             | 0.012μF (123) | E    | E  | E  |    |     | S    | S  | S  | S  |     | D    | D  | D  | D  | D   |
|             | 0.015μF (153) | E    | E  | E  |    |     | S    | S  | S  | S  |     | D    | D  | D  | D  | D   |
|             | 0.018μF (183) | E    | E  | E  |    |     | S    | S  | S  | S  |     | D    | D  | D  | D  | D   |
|             | 0.022μF (223) | E    | E  | E  |    |     | S    | S  | S  | S  |     | D    | D  | D  | D  | D   |
|             | 0.027μF (273) | E    | E  | E  |    |     | S    | S  | S  | S  |     | D    | D  | D  | D  | D   |
|             | 0.033μF (333) | E    | E  | E  |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.039μF (393) | E    | E  | E  |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.047μF (473) | E    | E  | E  |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.056μF (563) | E    | E  |    |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.068μF (683) | E    | E  |    |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.082μF (823) | E    | E  |    |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.10μF (104)  | E    | E  |    |    |     | S    | S  | S  | X  |     | D    | D  | D  | D  | D   |
|             | 0.12μF (124)  |      |    |    |    |     | S    | S  | X  |    |     | D    | D  | D  | D  | D   |
|             | 0.15μF (154)  |      |    |    |    |     | S    | S  | X  |    |     | D    | D  | D  | D  | D   |
|             | 0.18μF (184)  |      |    |    |    |     | S    | S  | X  |    |     | D    | D  | D  | D  | D   |
|             | 0.22μF (224)  |      |    |    |    |     | S    | S  | X  |    |     | D    | D  | D  | D  | D   |
|             | 0.27μF (274)  |      |    |    |    |     | X    | X  | X  |    |     | I    | I  | I  |    |     |
|             | 0.33μF (334)  |      |    |    |    |     | X    | X  | X  |    |     | I    | I  | I  |    |     |
|             | 0.39μF (394)  |      |    |    |    |     | X    | X  | X  |    |     | I    | I  | I  |    |     |
|             | 0.47μF (474)  |      |    |    |    |     | X    | X  | X  |    |     | I    | I  | I  |    |     |
|             | 0.56μF (564)  |      |    |    |    |     | X    | X  |    |    |     | I    | I  | I  |    |     |
|             | 0.68μF (684)  |      |    |    |    |     | X    | X  |    |    |     | I    | I  | I  |    |     |
|             | 0.82μF (824)  |      |    |    |    |     |      |    |    |    |     | I    | I  | I  |    |     |
|             | 1μF (105)     |      |    |    |    |     |      |    |    |    |     | I    | I  | I  |    |     |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

1206, 1210, 1812 Sizes

| DIELECTRIC    |               | X7R  |    |    |    |     |      |    |    |    |      |    |    |    |    |     |
|---------------|---------------|------|----|----|----|-----|------|----|----|----|------|----|----|----|----|-----|
| SIZE          |               | 1206 |    |    |    |     | 1210 |    |    |    | 1812 |    |    |    |    |     |
| RATED VOLTAGE |               | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100  | 10 | 16 | 25 | 50 | 100 |
| Capacitance   | 100pF (101)   |      |    |    |    |     |      |    |    |    |      |    |    |    |    |     |
|               | 120pF (121)   |      |    |    |    |     |      |    |    |    |      |    |    |    |    |     |
|               | 150pF (151)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 180pF (181)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 220pF (221)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 270pF (271)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 330pF (331)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 390pF (391)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 470pF (471)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 560pF (561)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 680pF (681)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 820pF (821)   | D    | D  | D  | D  | D   |      |    |    |    |      |    |    |    |    |     |
|               | 1,000pF (102) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 1,200pF (122) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 1,500pF (152) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 1,800pF (182) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 2,200pF (222) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 2,700pF (272) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 3,300pF (332) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 3,900pF (392) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 4,700pF (472) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 5,600pF (562) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 6,800pF (682) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 8,200pF (822) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.010μF (103) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.012μF (123) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.015μF (153) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.018μF (183) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.022μF (223) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.027μF (273) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.033μF (333) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.039μF (393) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.047μF (473) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.056μF (563) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.068μF (683) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.082μF (823) | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.10μF (104)  | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.12μF (124)  | D    | D  | D  | D  | D   | C    | C  | C  | C  | C    | D  | D  | D  | D  |     |
|               | 0.15μF (154)  | C    | C  | C  | C  | G   | C    | C  | C  | C  | D    | D  | D  | D  | D  |     |
|               | 0.18μF (184)  | C    | C  | C  | C  | G   | C    | C  | C  | C  | D    | D  | D  | D  | D  |     |
|               | 0.22μF (224)  | C    | C  | C  | C  | G   | C    | C  | C  | C  | D    | D  | D  | D  | D  |     |
|               | 0.27μF (274)  | C    | C  | C  | D  |     | C    | C  | C  | C  | G    | D  | D  | D  | D  |     |
|               | 0.33μF (334)  | C    | C  | C  | D  |     | C    | C  | C  | D  | G    | D  | D  | D  | D  |     |
|               | 0.39μF (394)  | C    | C  | J  | P  |     | C    | C  | C  | D  | M    | D  | D  | D  | D  |     |
|               | 0.47μF (474)  | J    | J  | J  | P  |     | C    | C  | C  | D  | M    | D  | D  | D  | K  |     |
|               | 0.56μF (564)  | J    | J  | J  | P  |     | D    | D  | D  | D  | M    | D  | D  | D  | K  |     |
|               | 0.68μF (684)  | J    | J  | J  | P  |     | D    | D  | D  | D  | K    | D  | D  | K  | K  |     |
|               | 0.82μF (824)  | J    | J  | J  | P  |     | D    | D  | D  | D  | K    | D  | D  | K  | K  |     |
|               | 1.0μF (105)   | J    | J  | J  | P  |     | D    | D  | D  | D  | K    | D  | D  | K  | K  |     |
|               | 1.5μF (155)   | J    | J  | P  |    |     |      |    |    |    |      |    |    |    | K  |     |
|               | 2.2μF (225)   | J    | J  | P  |    |     |      | K  | G  |    |      |    |    |    | M  |     |
|               | 3.3μF (335)   | P    | P  | P  |    |     |      |    | G  |    |      |    |    |    |    |     |
|               | 4.7μF (475)   | P    | P  | P  |    |     | K    | K  | K  |    |      |    |    |    |    |     |
|               | 6.8μF (685)   |      |    |    |    |     |      |    |    |    |      |    |    |    |    |     |
|               | 10μF (106)    |      |    |    |    |     |      | K  |    |    |      |    |    |    |    |     |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 7-2. CAPACITANCE RANGE (X5R Dielectric)

| Dielectric          |               | X5R  |    |    |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|---------------------|---------------|------|----|----|-----|------|----|----|----|------|----|----|----|------|-----|----|----|------|----|-----|----|----|----|----|
| Size                |               | 0402 |    |    |     | 0603 |    |    |    | 0805 |    |    |    | 1206 |     |    |    | 1210 |    |     |    |    |    |    |
| Rated Voltage (VDC) | 6.3           | 10   | 16 | 25 | 6.3 | 10   | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50   | 6.3 | 10 | 16 | 25   | 50 | 6.3 | 10 | 16 | 25 | 50 |
| Capacitance         | 0.027μF (273) |      | E  |    |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.033μF (333) |      | E  |    |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.039μF (393) |      | E  |    |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.047μF (473) |      | E  |    |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.056μF (563) |      | E  | E  |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.068μF (683) |      | E  | E  |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.082μF (823) | E    | E  | E  |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.10μF (104)  | E    | E  | E  | E   |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.15μF (154)  | E    | E  | E  | E   |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.22μF (224)  | E    | E  | E  | E   |      |    | X  | X  |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.27μF (274)  |      |    |    |     | X    | X  | X  |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.33μF (334)  | E    | E  |    |     | X    | X  | X  | X  |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.39μF (394)  |      |    |    |     |      | X  | X  | X  |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.47μF (474)  | E    | E  |    |     |      | X  | X  | X  |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.68μF (684)  | E    | E  |    |     | X    | X  | X  | X  |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 0.82uF (824)  |      |    |    |     | X    | X  | X  |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |
|                     | 1.0μF (105)   | E    | E  |    |     | X    | X  | X  | X  | X    | D  | D  | D  |      |     |    |    |      |    |     |    |    |    |    |
|                     | 1.5μF (155)   |      |    |    |     | X    |    |    |    |      | I  | I  | I  | I    |     |    | J  | J    |    |     | K  | K  |    |    |
|                     | 2.2μF (225)   | E    |    |    |     | X    | X  | X  |    |      | I  | I  | I  | I    |     |    | J  | J    | P  |     | K  | K  |    |    |
|                     | 3.3μF (335)   |      |    |    |     | X    | X  |    |    |      | I  | I  | I  | I    |     |    | P  | P    | P  |     |    |    |    |    |
|                     | 4.7μF (475)   |      |    |    |     | X    | X  | X  |    |      |    |    |    |      |     |    | P  | P    | P  | P   | K  | K  | K  |    |
|                     | 6.8uF (685)   |      |    |    |     |      |    |    |    |      |    |    |    |      |     |    | P  | P    |    |     |    |    |    |    |
|                     | 10μF (106)    |      |    |    |     |      |    |    |    |      |    |    |    |      |     |    | P  | P    | P  |     | K  | K  | K  |    |
|                     | 22μF (226)    |      |    |    |     |      |    |    |    |      |    |    |    |      |     |    |    |      |    |     |    |    |    |    |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 7-3. CAPACITANCE RANGE (Y5V Dielectric)

| DIELECTRIC    |               | Y5V  |    |    |    |    |      |    |    |  |  |
|---------------|---------------|------|----|----|----|----|------|----|----|--|--|
| SIZE          |               | 0402 |    |    |    |    | 0603 |    |    |  |  |
| RATED VOLTAGE | 6.3           | 10   | 16 | 25 | 50 | 10 | 16   | 25 | 50 |  |  |
| Capacitance   | 0.010μF (103) |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.015μF (153) |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.022μF (223) |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.033μF (333) |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.047μF (473) |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.068μF (683) |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.10μF (104)  |      | E  | E  | E  | S  | S    | S  | S  |  |  |
|               | 0.15μF (154)  |      | E  | E  |    | S  | S    | S  | S  |  |  |
|               | 0.22μF (224)  | E    | E  | E  |    | S  | S    | S  | S  |  |  |
|               | 0.33μF (334)  | E    | E  | E  |    | S  | S    | S  | S  |  |  |
|               | 0.47μF (474)  |      |    |    |    | S  | S    | X  |    |  |  |
|               | 0.68μF (684)  |      |    |    |    | S  | X    |    |    |  |  |
|               | 1.0μF (105)   |      |    |    |    | S  | X    | X  |    |  |  |
|               | 2.2μF (225)   |      |    |    |    | S  | X    |    |    |  |  |
|               | 4.7μF (475)   |      |    |    |    | X  |      |    |    |  |  |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 8. PACKAGING STYLE AND QUANTITY

| Size        | Thickness (mm)/Symbol | Paper tape |          | Plastic tape |          |
|-------------|-----------------------|------------|----------|--------------|----------|
|             |                       | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0402 (1005) | 0.50±0.20             | E          | 10k      | -            | -        |
| 0603 (1608) | 0.80±0.07             | S          | 4k       | 15k          | -        |
|             | 0.80+0.15/-0.10       | X          | 4k       | 15k          | -        |
| 0805 (2012) | 0.60±0.10             | A          | 4k       | 15k          | -        |
|             | 0.80±0.10             | B          | 4k       | 15k          | -        |
|             | 1.25±0.10             | D          | -        | -            | 3k       |
|             | 1.25±0.20             | I          | -        | -            | 3k       |
| 1206 (3216) | 0.80±0.10             | B          | 4k       | 15k          | -        |
|             | 0.95±0.10             | C          | -        | -            | 3k       |
|             | 1.15±0.15             | J          | -        | -            | 3k       |
|             | 1.25±0.10             | D          | -        | -            | 3k       |
|             | 1.60±0.20             | G          | -        | -            | 2k       |
|             | 1.60+0.30/-0.10       | P          | -        | -            | 2k       |
| 1210 (3225) | 0.95±0.10             | C          | -        | -            | 3k       |
|             | 1.25±0.10             | D          | -        | -            | 3k       |
|             | 1.60±0.20             | G          | -        | -            | 2k       |
|             | 2.00±0.20             | K          | -        | -            | 1k       |
|             | 2.50±0.30             | M          | -        | -            | 1k       |
| 1812 (4532) | 1.25±0.10             | D          | -        | -            | 1k       |
|             | 2.00±0.20             | K          | -        | -            | 1k       |

Unit: pieces

## 9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.                                                                            | Item                                                   | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                    | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                    |                                                       |               |                |                                                      |  |  |      |             |  |  |       |                                                                          |     |        |       |                                    |  |  |      |                                     |  |  |      |                           |     |        |       |                                                                                  |  |  |         |           |     |        |      |                                                                                     |  |  |       |                                                                                             |     |      |       |                                                                                               |  |  |       |                        |      |       |       |                                                                                         |  |  |       |             |  |  |       |     |            |        |                    |  |       |    |    |                                        |     |    |     |     |     |    |    |                                                                     |  |  |    |                                                         |                  |    |    |                             |  |  |       |              |                  |    |       |                                                                 |     |       |     |              |      |     |     |     |  |  |  |
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-------------------------------------------------------|--|--|-------|-------------|--|--|-------|-----|------------|--------|--------------------|--|-------|----|----|----------------------------------------|-----|----|-----|-----|-----|----|----|---------------------------------------------------------------------|--|--|----|---------------------------------------------------------|------------------|----|----|-----------------------------|--|--|-------|--------------|------------------|----|-------|-----------------------------------------------------------------|-----|-------|-----|--------------|------|-----|-----|-----|--|--|--|
| 1.                                                                             | Visual and Mechanical                                  | ---                                                                                                                                                                                                                                                                                                                                                                                                                                               | * No remarkable defect.<br>* Dimensions to conform to individual specification sheet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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                    |                                                       |               |                |                                                      |  |  |      |             |  |  |       |                                                                          |     |        |       |                                    |  |  |      |                                     |  |  |      |                           |     |        |       |                                                                                  |  |  |         |           |     |        |      |                                                                                     |  |  |       |                                                                                             |     |      |       |                                                                                               |  |  |       |                        |      |       |       |                                                                                         |  |  |       |             |  |  |       |     |            |        |                    |  |       |    |    |                                        |     |    |     |     |     |    |    |                                                                     |  |  |    |                                                         |                  |    |    |                             |  |  |       |              |                  |    |       |                                                                 |     |       |     |              |      |     |     |     |  |  |  |
| 2.                                                                             | Capacitance                                            | Class I: NP0<br>Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%<br>Cap>1000pF 1.0±0.2Vrms, 1KHz±10%                                                                                                                                                                                                                                                                                                                                                              | * Shall not exceed the limits given in the detailed spec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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                                                  |  |  |       |             |  |  |       |     |            |        |                    |  |       |    |    |                                        |     |    |     |     |     |    |    |                                                                     |  |  |    |                                                         |                  |    |    |                             |  |  |       |              |                  |    |       |                                                                 |     |       |     |              |      |     |     |     |  |  |  |
| 3.                                                                             | Q/D.F.<br>(Dissipation Factor)                         | NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C<br>X7R,X5R,X6S:<br><br>Class II: X7R, X5R, X6S, Y5V<br>Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% **<br>Cap>10μF, 0.5±0.2Vrms, 120Hz±20%<br><br>** Test condition: 0.5±0.2Vrms · 1KHz±10%<br>X7R: 0603≥225(10V),<br>0805=106(6.3V&10V)<br>X5R: 01R5≥103, 0201≥224 (6.3V,10V),<br>0402≥475 (6.3V), 0402≥225(10V),<br>0603=106 (6.3V,10V),<br>TT18X≥475(10V) , TT15X series<br>X6S:0201≥224 (6.3V),0402≥225 (6.3V), | NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C<br>X7R,X5R,X6S:<br><br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>≥ 100V</td> <td>≤ 2.5%</td> <td>≤ 3%</td> <td>1206≥ 0.47μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 5%</td> <td>0805 &gt; 0.1μF, 0603≥ 0.068μF</td> </tr> <tr> <td>50V</td> <td>≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603≥ 0.047μF; 0805≥ 0.18μF; 1206≥ 0.47μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 5%</td> <td>1210≥ 4.7μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 10%</td> <td>0402≥ 0.1μF; 0603≥ 1μF; 0805≥ 1μF; 1206≥ 2.2μF;<br/>1210≥ 10μF; TT series</td> </tr> <tr> <td>35V</td> <td>≤ 3.5%</td> <td>≤ 10%</td> <td>0603≥ 1μF; 0805≥ 2.2μF; 1210≥ 10μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 5%</td> <td>0201≥ 0.01μF; 0805≥ 1μF; 1210≥ 10μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 7%</td> <td>0603≥ 0.33μF; 1206≥ 4.7μF</td> </tr> <tr> <td>25V</td> <td>≤ 3.5%</td> <td>≤ 10%</td> <td>0402≥ 0.10μF; 0603≥ 0.47μF; 0805≥ 2.2μF;<br/>1206≥ 6.8μF ; 1210≥ 22μF ; TT series</td> </tr> <tr> <td></td> <td></td> <td>≤ 12.5%</td> <td>0402≥ 1μF</td> </tr> <tr> <td>16V</td> <td>≤ 3.5%</td> <td>≤ 5%</td> <td>0201≥ 0.01μF; 0402≥ 0.033μF; 0603≥ 0.15μF; 0805≥ 0.68μF<br/>1206≥ 2.2μF; 1210≥ 4.7μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 10%</td> <td>0201≥ 0.1μF; 0402≥ 0.22μF; 0603≥ 0.68μF; 0805≥ 2.2μF;<br/>1206≥ 4.7μF; 1210≥ 22μF; TT series</td> </tr> <tr> <td>10V</td> <td>≤ 5%</td> <td>≤ 10%</td> <td>0201≥ 0.012μF; 0402≥ 0.33μF; 0603≥ 0.33μF; 0805≥ 2.2μF;<br/>1206≥ 2.2μF; 1210≥ 22μF; TT series</td> </tr> <tr> <td></td> <td></td> <td>≤ 15%</td> <td>0201≥ 0.1μF; 0402≥ 1μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 10%</td> <td>≤ 15%</td> <td>0201≥ 0.1μF; 0402≥ 1μF; 0603≥ 10μF; 0805≥ 4.7μF;<br/>1206≥ 47μF ; 1210≥ 100μF; TT series</td> </tr> <tr> <td></td> <td></td> <td>≤ 20%</td> <td>0402≥ 2.2μF</td> </tr> <tr> <td></td> <td></td> <td>≤ 15%</td> <td>---</td> </tr> </tbody> </table><br>Y5V:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50V</td> <td>5%</td> <td>7%</td> <td>0603≥ 0.1μF; 0805≥ 0.47μF; 1206≥ 4.7μF</td> </tr> <tr> <td>35V</td> <td>7%</td> <td>---</td> <td>---</td> </tr> <tr> <td>25V</td> <td>5%</td> <td>7%</td> <td>0402≥ 0.047μF; 0603≥ 0.1μF;<br/>0805≥ 0.33μF; 1206≥ 1μF; 1210≥ 4.7μF</td> </tr> <tr> <td></td> <td></td> <td>9%</td> <td>0402≥ 0.068μF; 0603≥ 0.47μF;<br/>1206≥ 4.7μF; 1210≥ 22μF</td> </tr> <tr> <td>16V<br/>(C&lt;1.0μF)</td> <td>7%</td> <td>9%</td> <td>0402≥ 0.068μF; 0603≥ 0.68μF</td> </tr> <tr> <td></td> <td></td> <td>12.5%</td> <td>0402≥ 0.22μF</td> </tr> <tr> <td>16V<br/>(C≥1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0603≥ 2.2μF; 0805≥ 3.3μF;<br/>1206≥ 10μF; 1210≥ 22μF; 1812≥ 47μF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F.≤ |                       | ≥ 100V                                                       | ≤ 2.5%                                                 | ≤ 3%                       | 1206≥ 0.47μF                                                |                                                              |                                                                                | ≤ 5%      | 0805 > 0.1μF, 0603≥ 0.068μF | 50V                                                   | ≤ 2.5%        | ≤ 3%           | 0201(50V); 0603≥ 0.047μF; 0805≥ 0.18μF; 1206≥ 0.47μF |  |  | ≤ 5% | 1210≥ 4.7μF |  |  | ≤ 10% | 0402≥ 0.1μF; 0603≥ 1μF; 0805≥ 1μF; 1206≥ 2.2μF;<br>1210≥ 10μF; TT series | 35V | ≤ 3.5% | ≤ 10% | 0603≥ 1μF; 0805≥ 2.2μF; 1210≥ 10μF |  |  | ≤ 5% | 0201≥ 0.01μF; 0805≥ 1μF; 1210≥ 10μF |  |  | ≤ 7% | 0603≥ 0.33μF; 1206≥ 4.7μF | 25V | ≤ 3.5% | ≤ 10% | 0402≥ 0.10μF; 0603≥ 0.47μF; 0805≥ 2.2μF;<br>1206≥ 6.8μF ; 1210≥ 22μF ; TT series |  |  | ≤ 12.5% | 0402≥ 1μF | 16V | ≤ 3.5% | ≤ 5% | 0201≥ 0.01μF; 0402≥ 0.033μF; 0603≥ 0.15μF; 0805≥ 0.68μF<br>1206≥ 2.2μF; 1210≥ 4.7μF |  |  | ≤ 10% | 0201≥ 0.1μF; 0402≥ 0.22μF; 0603≥ 0.68μF; 0805≥ 2.2μF;<br>1206≥ 4.7μF; 1210≥ 22μF; TT series | 10V | ≤ 5% | ≤ 10% | 0201≥ 0.012μF; 0402≥ 0.33μF; 0603≥ 0.33μF; 0805≥ 2.2μF;<br>1206≥ 2.2μF; 1210≥ 22μF; TT series |  |  | ≤ 15% | 0201≥ 0.1μF; 0402≥ 1μF | 6.3V | ≤ 10% | ≤ 15% | 0201≥ 0.1μF; 0402≥ 1μF; 0603≥ 10μF; 0805≥ 4.7μF;<br>1206≥ 47μF ; 1210≥ 100μF; TT series |  |  | ≤ 20% | 0402≥ 2.2μF |  |  | ≤ 15% | --- | Rated vol. | D.F. ≤ | Exception of D.F.≤ |  | ≥ 50V | 5% | 7% | 0603≥ 0.1μF; 0805≥ 0.47μF; 1206≥ 4.7μF | 35V | 7% | --- | --- | 25V | 5% | 7% | 0402≥ 0.047μF; 0603≥ 0.1μF;<br>0805≥ 0.33μF; 1206≥ 1μF; 1210≥ 4.7μF |  |  | 9% | 0402≥ 0.068μF; 0603≥ 0.47μF;<br>1206≥ 4.7μF; 1210≥ 22μF | 16V<br>(C<1.0μF) | 7% | 9% | 0402≥ 0.068μF; 0603≥ 0.68μF |  |  | 12.5% | 0402≥ 0.22μF | 16V<br>(C≥1.0μF) | 9% | 12.5% | 0603≥ 2.2μF; 0805≥ 3.3μF;<br>1206≥ 10μF; 1210≥ 22μF; 1812≥ 47μF | 10V | 12.5% | 20% | 0402≥ 0.47μF | 6.3V | 20% | --- | --- |  |  |  |
| Rated vol.                                                                     | D.F. ≤                                                 | Exception of D.F.≤                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                          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                    |                                                       |               |                |                                                      |  |  |      |             |  |  |       |                                                                          |     |        |       |                                    |  |  |      |                                     |  |  |      |                           |     |        |       |                                                                                  |  |  |         |           |     |        |      |                                                                                     |  |  |       |                                                                                             |     |      |       |                                                                                               |  |  |       |                        |      |       |       |                                                                                         |  |  |       |             |  |  |       |     |            |        |                    |  |       |    |    |                                        |     |    |     |     |     |    |    |                                                                     |  |  |    |                                                         |                  |    |    |                             |  |  |       |              |                  |    |       |                                                                 |     |       |     |              |      |     |     |     |  |  |  |
| ≥ 100V                                                                         | ≤ 2.5%                                                 | ≤ 3%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1206≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                             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|                                                                                |                                                        | ≤ 5%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0805 > 0.1μF, 0603≥ 0.068μF                                                                                                                                                                                                                                                                                                                                                                                                              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| 50V                                                                            | ≤ 2.5%                                                 | ≤ 3%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0201(50V); 0603≥ 0.047μF; 0805≥ 0.18μF; 1206≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                     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|                                                                                |                                                        | ≤ 5%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1210≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                              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|                                                                                |                                                        | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0402≥ 0.1μF; 0603≥ 1μF; 0805≥ 1μF; 1206≥ 2.2μF;<br>1210≥ 10μF; TT series                                                                                                                                                                                                                                                                                                                                                                 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| 35V                                                                            | ≤ 3.5%                                                 | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0603≥ 1μF; 0805≥ 2.2μF; 1210≥ 10μF                                                                                                                                                                                                                                                                                                                                                                                                       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|                                                                                |                                                        | ≤ 5%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0201≥ 0.01μF; 0805≥ 1μF; 1210≥ 10μF                                                                                                                                                                                                                                                                                                                                                                                                      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|                                                                                |                                                        | ≤ 7%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0603≥ 0.33μF; 1206≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                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| 25V                                                                            | ≤ 3.5%                                                 | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0402≥ 0.10μF; 0603≥ 0.47μF; 0805≥ 2.2μF;<br>1206≥ 6.8μF ; 1210≥ 22μF ; TT series                                                                                                                                                                                                                                                                                                                                                         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|                                                                                |                                                        | ≤ 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0402≥ 1μF                                                                                                                                                                                                                                                                                                                                                                                                                                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| 16V                                                                            | ≤ 3.5%                                                 | ≤ 5%                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0201≥ 0.01μF; 0402≥ 0.033μF; 0603≥ 0.15μF; 0805≥ 0.68μF<br>1206≥ 2.2μF; 1210≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                      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|                                                                                |                                                        | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0201≥ 0.1μF; 0402≥ 0.22μF; 0603≥ 0.68μF; 0805≥ 2.2μF;<br>1206≥ 4.7μF; 1210≥ 22μF; TT series                                                                                                                                                                                                                                                                                                                                              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| 10V                                                                            | ≤ 5%                                                   | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0201≥ 0.012μF; 0402≥ 0.33μF; 0603≥ 0.33μF; 0805≥ 2.2μF;<br>1206≥ 2.2μF; 1210≥ 22μF; TT series                                                                                                                                                                                                                                                                                                                                            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|                                                                                |                                                        | ≤ 15%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0201≥ 0.1μF; 0402≥ 1μF                                                                                                                                                                                                                                                                                                                                                                                                                   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| 6.3V                                                                           | ≤ 10%                                                  | ≤ 15%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0201≥ 0.1μF; 0402≥ 1μF; 0603≥ 10μF; 0805≥ 4.7μF;<br>1206≥ 47μF ; 1210≥ 100μF; TT series                                                                                                                                                                                                                                                                                                                                                  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|                                                                                |                                                        | ≤ 20%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0402≥ 2.2μF                                                                                                                                                                                                                                                                                                                                                                                                                              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|                                                                                |                                                        | ≤ 15%                                                                                                                                                                                                                                                                                                                                                                                                                                             | ---                                                                                                                                                                                                                                                                                                                                                                                                                                      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| Rated vol.                                                                     | D.F. ≤                                                 | Exception of D.F.≤                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| ≥ 50V                                                                          | 5%                                                     | 7%                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0603≥ 0.1μF; 0805≥ 0.47μF; 1206≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                   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| 35V                                                                            | 7%                                                     | ---                                                                                                                                                                                                                                                                                                                                                                                                                                               | ---                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 25V                                                                            | 5%                                                     | 7%                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0402≥ 0.047μF; 0603≥ 0.1μF;<br>0805≥ 0.33μF; 1206≥ 1μF; 1210≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                      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|                                                                                |                                                        | 9%                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0402≥ 0.068μF; 0603≥ 0.47μF;<br>1206≥ 4.7μF; 1210≥ 22μF                                                                                                                                                                                                                                                                                                                                                                                  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| 16V<br>(C<1.0μF)                                                               | 7%                                                     | 9%                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0402≥ 0.068μF; 0603≥ 0.68μF                                                                                                                                                                                                                                                                                                                                                                                                              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|                                                                                |                                                        | 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0402≥ 0.22μF                                                                                                                                                                                                                                                                                                                                                                                                                             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| 16V<br>(C≥1.0μF)                                                               | 9%                                                     | 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0603≥ 2.2μF; 0805≥ 3.3μF;<br>1206≥ 10μF; 1210≥ 22μF; 1812≥ 47μF                                                                                                                                                                                                                                                                                                                                                                          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| 10V                                                                            | 12.5%                                                  | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0402≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                             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| 6.3V                                                                           | 20%                                                    | ---                                                                                                                                                                                                                                                                                                                                                                                                                                               | ---                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 4.                                                                             | Dielectric Strength                                    | * To apply voltage (≤100V) 250%.<br>* Duration: 1 to 5 sec.<br>* Charge and discharge current less than 50mA.                                                                                                                                                                                                                                                                                                                                     | * No evidence of damage or flash over during test.                                                                                                                                                                                                                                                                                                                                                                                       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| 5.                                                                             | Insulation Resistance                                  | To apply rated voltage for max. 120 sec.                                                                                                                                                                                                                                                                                                                                                                                                          | 10GΩ or Rx <sub>C</sub> ≥500Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, Y5V)                                                                                                                                                                                                                                                                                                                                                   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|                                                                                |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R<br/>50V: 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF</td> <td rowspan="6">10GΩ or Rx<sub>C</sub>≥100 Ω-F whichever is smaller.</td> </tr> <tr> <td>35V: 0805≥2.2μF; 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF;<br/>1206≥4.7μF; 1210≥47μF</td> </tr> <tr> <td>6.3V ; 4V</td> </tr> <tr> <td>50V: 0402≥0.1μF</td> <td rowspan="4">10GΩ or Rx<sub>C</sub>≥50 Ω-F whichever is smaller.</td> </tr> <tr> <td>35V: 0603≥1μF</td> </tr> <tr> <td>10V: 0603≥10μF</td> </tr> <tr> <td>4V: 0603≥22μF; 0805≥47μF</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |        | Rated voltage      | Insulation Resistance | 100V: X7R<br>50V: 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF | 10GΩ or Rx <sub>C</sub> ≥100 Ω-F whichever is smaller. | 35V: 0805≥2.2μF; 1210≥10μF | 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF | 16V: 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF | 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF;<br>1206≥4.7μF; 1210≥47μF | 6.3V ; 4V | 50V: 0402≥0.1μF             | 10GΩ or Rx <sub>C</sub> ≥50 Ω-F whichever is smaller. | 35V: 0603≥1μF | 10V: 0603≥10μF | 4V: 0603≥22μF; 0805≥47μF                             |  |  |      |             |  |  |       |                                                                          |     |        |       |                                    |  |  |      |                                     |  |  |      |                           |     |        |       |                                                                                  |  |  |         |           |     |        |      |                                                                                     |  |  |       |                                                                                             |     |      |       |                                                                                               |  |  |       |                        |      |       |       |                                                                                         |  |  |       |             |  |  |       |     |            |        |                    |  |       |    |    |                                        |     |    |     |     |     |    |    |                                                                     |  |  |    |                                                         |                  |    |    |                             |  |  |       |              |                  |    |       |                                                                 |     |       |     |              |      |     |     |     |  |  |  |
| Rated voltage                                                                  | Insulation Resistance                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 100V: X7R<br>50V: 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF                   | 10GΩ or Rx <sub>C</sub> ≥100 Ω-F whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 35V: 0805≥2.2μF; 1210≥10μF                                                     |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF                    |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 16V: 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF                   |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF;<br>1206≥4.7μF; 1210≥47μF |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 6.3V ; 4V                                                                      |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 50V: 0402≥0.1μF                                                                | 10GΩ or Rx <sub>C</sub> ≥50 Ω-F whichever is smaller.  |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 35V: 0603≥1μF                                                                  |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 10V: 0603≥10μF                                                                 |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 4V: 0603≥22μF; 0805≥47μF                                                       |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          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| No.  | Item                             | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Requirements                                                                                                                                                                                                                                                                                   |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
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| 6.   | Temperature Coefficient          | With no electrical load.<br><table border="1"> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>-55~85°C at 25°C</td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> </tr> <tr> <td>Y5V</td> <td>-25~85°C at 20°C</td> </tr> </table>                                                                                                                                                                                                                                                        | T.C.                                                                                                                                                                                                                                                                                           | Operating Temp | NPO         | -55~125°C at 25°C | X7R                        | -55~125°C at 25°C | X5R | -55~85°C at 25°C | X6S | -55~105°C at 25°C | Y5V                        | -25~85°C at 20°C | <table border="1"> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> <tr> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>X6S</td> <td>Within ±22%</td> </tr> <tr> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </table> | T.C.       | Capacitance Change | NPO                                                                                                                                                                                                                      | Within ±30ppm/°C | X7R | Within ±15% | X5R | Within ±15% | X6S | Within ±22% | Y5V | Within +30%/-80% |
| T.C. | Operating Temp                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| NPO  | -55~125°C at 25°C                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| X7R  | -55~125°C at 25°C                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| X5R  | -55~85°C at 25°C                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| X6S  | -55~105°C at 25°C                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| Y5V  | -25~85°C at 20°C                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| T.C. | Capacitance Change               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| NPO  | Within ±30ppm/°C                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| X7R  | Within ±15%                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| X5R  | Within ±15%                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| X6S  | Within ±22%                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| Y5V  | Within +30%/-80%                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 7.   | Adhesive Strength of Termination | * Pressurizing force :<br>5N (≤0603) and 10N (>0603)<br>* Test time: 10±1 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | * No remarkable damage or removal of the terminations.                                                                                                                                                                                                                                         |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 8.   | Vibration Resistance             | * Vibration frequency: 10~55 Hz/min.<br>* Total amplitude: 1.5mm<br>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                                                                                                                                                     | * No remarkable damage.<br>* Cap change and Q/D.F.: To meet initial spec.                                                                                                                                                                                                                      |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 9.   | Solderability                    | * Solder temperature: 235±5°C<br>* Dipping time: 2±0.5 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 95% min. coverage of all metallized area.                                                                                                                                                                                                                                                      |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 10.  | Bending Test                     | *The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes : 5 mm and then the pressure shall be maintained for 5±1 sec.<br>*Measurement to be made after keeping at room temp. for 24±2 hrs..                                                                                                                                                                                                                                                                                                                                      | * No remarkable damage.<br>* Cap change :<br>NPO: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S: within ±12.5%<br>Y5V: within ±30%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 11.  | Resistance to Soldering Heat     | * Solder temperature: 260±5°C<br>* Dipping time: 10±1 sec<br>* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.<br>* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                          | * No remarkable damage.<br>* Cap change:<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S: within ±7.5%<br>Y5V: within ±20%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.<br>* 25% max. leaching on each edge.                                   |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 12.  | Temperature Cycle                | * Conduct the five cycles according to the temperatures and time.<br><table border="1"> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </table><br>* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | Step                                                                                                                                                                                                                                                                                           | Temp. (°C)     | Time (min.) | 1                 | Min. operating temp. +0/-3 | 30±3              | 2   | Room temp.       | 2~3 | 3                 | Max. operating temp. +3/-0 | 30±3             | 4                                                                                                                                                                                                                                                                                                                           | Room temp. | 2~3                | * No remarkable damage.<br>* Cap change :<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S: within ±7.5%<br>Y5V: within ±20%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements. |                  |     |             |     |             |     |             |     |                  |
| Step | Temp. (°C)                       | Time (min.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 1    | Min. operating temp. +0/-3       | 30±3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 2    | Room temp.                       | 2~3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 3    | Max. operating temp. +3/-0       | 30±3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |
| 4    | Room temp.                       | 2~3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                |                |             |                   |                            |                   |     |                  |     |                   |                            |                  |                                                                                                                                                                                                                                                                                                                             |            |                    |                                                                                                                                                                                                                          |                  |     |             |     |             |     |             |     |                  |

| No.                                | Item                              | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| 13.                                | Humidity (Damp Heat) Steady State | <ul style="list-style-type: none"> <li>* Test temp.: <math>40 \pm 2^\circ\text{C}</math></li> <li>* Humidity: 90~95% RH</li> <li>* Test time: <math>500 + 24/-0\text{hrs}</math>.</li> <li>* Before initial measurement (Class II only): Perform <math>150 + 0/-10^\circ\text{C}</math> for 1 hr and then set for <math>24 \pm 2</math> hrs at room temp.</li> <li>* Measurement to be made after keeping at room temp. for <math>24 \pm 2</math> hrs.</li> </ul>                          | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change:<br/>NPO: within <math>\pm 5\%</math> or <math>0.5\mu\text{F}</math> whichever is larger<br/>X7R, X5R, X6S: <math>\geq 10\text{V}^{**}</math>, within <math>\pm 12.5\%</math>; <math>\leq 6.3\text{V}</math> within <math>\pm 25\%</math>; TT series &amp; <math>C \geq 1\mu\text{F}</math>, within <math>\pm 25\%</math><br/><math>**10\text{V}</math>: <math>0603 \geq 4.7\mu\text{F}</math>; <math>0402 \geq 1\mu\text{F}</math>; <math>0201 \geq 0.1\mu\text{F}</math>, within <math>\pm 25\%</math><br/><math>Y5V</math>: <math>\geq 10\text{V}</math>, within <math>\pm 30\%</math>; <math>\leq 6.3\text{V}</math>, within <math>+30/-40\%</math></li> <li>* Q/D.F. value:<br/>NPO: More than <math>30\text{pF}</math> <math>Q \geq 350</math>, <math>10\text{pF} \leq C \leq 30\text{pF}</math>, <math>Q \geq 275 + 2.5\text{C}</math><br/>Less than <math>10\text{pF}</math> <math>Q \geq 200 + 10\text{C}</math></li> </ul> <p>X7R, X5R, X6S:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated</th> <th>D.F. <math>\leq</math></th> <th>Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq 100\text{V}</math></td> <td><math>\leq 3\%</math></td> <td><math>\leq 6\%</math> <math>1206 \geq 0.47\mu\text{F}</math><br/><math>\leq 7.5\%</math> <math>0805 \geq 0.1\mu\text{F}</math>, <math>0603 \geq 0.068\mu\text{F}</math></td> </tr> <tr> <td><math>\geq 50\text{V}</math></td> <td><math>\leq 3\%</math></td> <td><math>\leq 6\%</math> <math>0201(50\text{V})</math>; <math>0603 \geq 0.047\mu\text{F}</math>; <math>0805 \geq 0.18\mu\text{F}</math>; <math>1206 \geq 0.47\mu\text{F}</math><br/><math>\leq 10\%</math> <math>1210 \geq 4.7\mu\text{F}</math><br/><math>\leq 20\%</math> <math>0402 \geq 0.1\mu\text{F}</math>; <math>0603 \geq 1\mu\text{F}</math>; <math>0805 \geq 1\mu\text{F}</math>; <math>1206 \geq 2.2\mu\text{F}</math>; <math>1210 \geq 10\mu\text{F}</math>; TT series</td> </tr> <tr> <td>35V</td> <td><math>\leq 5\%</math></td> <td><math>\leq 20\%</math> <math>0603 \geq 1\mu\text{F}</math>; <math>0805 \geq 2.2\mu\text{F}</math>; <math>1210 \geq 10\mu\text{F}</math><br/><math>\leq 10\%</math> <math>0201 \geq 0.01\mu\text{F}</math>; <math>0805 \geq 1\mu\text{F}</math>; <math>1210 \geq 10\mu\text{F}</math><br/><math>\leq 14\%</math> <math>0603 \geq 0.33\mu\text{F}</math>; <math>1206 \geq 4.7\mu\text{F}</math><br/><math>\leq 15\%</math> <math>0402 \geq 0.10\mu\text{F}</math>; <math>0603 \geq 0.47\mu\text{F}</math>; <math>0805 \geq 2.2\mu\text{F}</math>; <math>1206 \geq 6.8\mu\text{F}</math>; <math>1210 \geq 22\mu\text{F}</math>; TT series<br/><math>\leq 20\%</math> <math>0402 \geq 1\mu\text{F}</math></td> </tr> <tr> <td>25V</td> <td><math>\leq 5\%</math></td> <td><math>\leq 10\%</math> <math>0603 \geq 0.15\mu\text{F}</math>; <math>0805 \geq 0.68\mu\text{F}</math>; <math>1206 \geq 2.2\mu\text{F}</math>; <math>1210 \geq 4.7\mu\text{F}</math><br/><math>\leq 15\%</math> <math>0201 \geq 0.01\mu\text{F}</math>; <math>0402 \geq 0.033\mu\text{F}</math>; <math>0603 \geq 0.68\mu\text{F}</math>; <math>0805 \geq 2.2\mu\text{F}</math>; <math>1206 \geq 4.7\mu\text{F}</math>; <math>1210 \geq 22\mu\text{F}</math>; TT series</td> </tr> <tr> <td>16V</td> <td><math>\leq 5\%</math></td> <td><math>\leq 15\%</math> <math>0201 \geq 0.012\mu\text{F}</math>; <math>0402 \geq 0.33\mu\text{F}</math>; <math>0603 \geq 0.33\mu\text{F}</math>; <math>0805 \geq 2.2\mu\text{F}</math>; <math>1206 \geq 2.2\mu\text{F}</math>; <math>1210 \geq 22\mu\text{F}</math><br/><math>\leq 20\%</math> <math>0201 \geq 0.1\mu\text{F}</math>; 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<math>1812 \geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30% <math>0402 \geq 0.47\mu\text{F}</math></td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>---</td> </tr> </tbody> </table> | Rated | D.F. $\leq$ | Exception of D.F. $\leq$ | $\geq 100\text{V}$ | $\leq 3\%$ | $\leq 6\%$ $1206 \geq 0.47\mu\text{F}$<br>$\leq 7.5\%$ $0805 \geq 0.1\mu\text{F}$ , $0603 \geq 0.068\mu\text{F}$ | $\geq 50\text{V}$ | $\leq 3\%$ | $\leq 6\%$ $0201(50\text{V})$ ; $0603 \geq 0.047\mu\text{F}$ ; $0805 \geq 0.18\mu\text{F}$ ; $1206 \geq 0.47\mu\text{F}$<br>$\leq 10\%$ $1210 \geq 4.7\mu\text{F}$<br>$\leq 20\%$ $0402 \geq 0.1\mu\text{F}$ ; $0603 \geq 1\mu\text{F}$ ; $0805 \geq 1\mu\text{F}$ ; $1206 \geq 2.2\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$ ; TT series | 35V | $\leq 5\%$ | $\leq 20\%$ $0603 \geq 1\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$<br>$\leq 10\%$ $0201 \geq 0.01\mu\text{F}$ ; $0805 \geq 1\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$<br>$\leq 14\%$ $0603 \geq 0.33\mu\text{F}$ ; 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$0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 2.2\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$<br>$\leq 20\%$ $0201 \geq 0.1\mu\text{F}$ ; $0402 \geq 1\mu\text{F}$ ; TT series | 6.3V | $\leq 15\%$ | $\leq 30\%$ $0201 \geq 0.1\mu\text{F}$ ; $0402 \geq 1\mu\text{F}$ ; $0603 \geq 10\mu\text{F}$ ; $0805 \geq 4.7\mu\text{F}$ ; $1206 \geq 47\mu\text{F}$ ; $1210 \geq 100\mu\text{F}$ ; TT series | 4V | $\leq 20\%$ | --- | Rated vol. | D.F. $\leq$ | Exception of D.F. $\leq$ | $\geq 50\text{V}$ | 7.5% | 10% $0603 \geq 0.1\mu\text{F}$ ; $0805 \geq 0.47\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$ | 35V | 10% | --- | 25V | 7.5% | 10% $0402 \geq 0.047\mu\text{F}$ ; $0603 \geq 0.1\mu\text{F}$ ; $0805 \geq 0.33\mu\text{F}$ ; $1206 \geq 1\mu\text{F}$ ; $1210 \geq 4.7\mu\text{F}$<br>15% $0402 \geq 0.068\mu\text{F}$ ; $0603 \geq 0.47\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$ | 16V<br>( $C < 1.0\mu\text{F}$ ) | 10% | 12.5% $0402 \geq 0.068\mu\text{F}$ ; $0603 \geq 0.68\mu\text{F}$<br>20% $0402 \geq 0.22\mu\text{F}$ | 16V<br>( $C \geq 1.0\mu\text{F}$ ) | 12.5% | 20% $0603 \geq 2.2\mu\text{F}$ ; $0805 \geq 3.3\mu\text{F}$ ; $1206 \geq 10\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$ ; $1812 \geq 47\mu\text{F}$ | 10V | 20% | 30% $0402 \geq 0.47\mu\text{F}$ | 6.3V | 30% | --- |
| Rated                              | D.F. $\leq$                       | Exception of D.F. $\leq$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| $\geq 100\text{V}$                 | $\leq 3\%$                        | $\leq 6\%$ $1206 \geq 0.47\mu\text{F}$<br>$\leq 7.5\%$ $0805 \geq 0.1\mu\text{F}$ , $0603 \geq 0.068\mu\text{F}$                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| $\geq 50\text{V}$                  | $\leq 3\%$                        | $\leq 6\%$ $0201(50\text{V})$ ; $0603 \geq 0.047\mu\text{F}$ ; $0805 \geq 0.18\mu\text{F}$ ; $1206 \geq 0.47\mu\text{F}$<br>$\leq 10\%$ $1210 \geq 4.7\mu\text{F}$<br>$\leq 20\%$ $0402 \geq 0.1\mu\text{F}$ ; $0603 \geq 1\mu\text{F}$ ; $0805 \geq 1\mu\text{F}$ ; $1206 \geq 2.2\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$ ; TT series                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 35V                                | $\leq 5\%$                        | $\leq 20\%$ $0603 \geq 1\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$<br>$\leq 10\%$ $0201 \geq 0.01\mu\text{F}$ ; $0805 \geq 1\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$<br>$\leq 14\%$ $0603 \geq 0.33\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$<br>$\leq 15\%$ $0402 \geq 0.10\mu\text{F}$ ; $0603 \geq 0.47\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 6.8\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$ ; TT series<br>$\leq 20\%$ $0402 \geq 1\mu\text{F}$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 25V                                | $\leq 5\%$                        | $\leq 10\%$ $0603 \geq 0.15\mu\text{F}$ ; $0805 \geq 0.68\mu\text{F}$ ; $1206 \geq 2.2\mu\text{F}$ ; $1210 \geq 4.7\mu\text{F}$<br>$\leq 15\%$ $0201 \geq 0.01\mu\text{F}$ ; $0402 \geq 0.033\mu\text{F}$ ; $0603 \geq 0.68\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$ ; TT series                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 16V                                | $\leq 5\%$                        | $\leq 15\%$ $0201 \geq 0.012\mu\text{F}$ ; $0402 \geq 0.33\mu\text{F}$ ; $0603 \geq 0.33\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 2.2\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$<br>$\leq 20\%$ $0201 \geq 0.1\mu\text{F}$ ; $0402 \geq 1\mu\text{F}$ ; TT series                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 10V                                | $\leq 7.5\%$                      | $\leq 15\%$ $0201 \geq 0.012\mu\text{F}$ ; $0402 \geq 0.33\mu\text{F}$ ; $0603 \geq 0.33\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 2.2\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$<br>$\leq 20\%$ $0201 \geq 0.1\mu\text{F}$ ; $0402 \geq 1\mu\text{F}$ ; TT series                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 6.3V                               | $\leq 15\%$                       | $\leq 30\%$ $0201 \geq 0.1\mu\text{F}$ ; $0402 \geq 1\mu\text{F}$ ; $0603 \geq 10\mu\text{F}$ ; $0805 \geq 4.7\mu\text{F}$ ; $1206 \geq 47\mu\text{F}$ ; $1210 \geq 100\mu\text{F}$ ; TT series                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 4V                                 | $\leq 20\%$                       | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| Rated vol.                         | D.F. $\leq$                       | Exception of D.F. $\leq$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| $\geq 50\text{V}$                  | 7.5%                              | 10% $0603 \geq 0.1\mu\text{F}$ ; $0805 \geq 0.47\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 35V                                | 10%                               | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 25V                                | 7.5%                              | 10% $0402 \geq 0.047\mu\text{F}$ ; $0603 \geq 0.1\mu\text{F}$ ; $0805 \geq 0.33\mu\text{F}$ ; $1206 \geq 1\mu\text{F}$ ; $1210 \geq 4.7\mu\text{F}$<br>15% $0402 \geq 0.068\mu\text{F}$ ; $0603 \geq 0.47\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 16V<br>( $C < 1.0\mu\text{F}$ )    | 10%                               | 12.5% $0402 \geq 0.068\mu\text{F}$ ; $0603 \geq 0.68\mu\text{F}$<br>20% $0402 \geq 0.22\mu\text{F}$                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 16V<br>( $C \geq 1.0\mu\text{F}$ ) | 12.5%                             | 20% $0603 \geq 2.2\mu\text{F}$ ; $0805 \geq 3.3\mu\text{F}$ ; $1206 \geq 10\mu\text{F}$ ; $1210 \geq 22\mu\text{F}$ ; $1812 \geq 47\mu\text{F}$                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 10V                                | 20%                               | 30% $0402 \geq 0.47\mu\text{F}$                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 6.3V                               | 30%                               | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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\*I.R.:  $\geq 10\text{V}$ ,  $1\text{G}\Omega$  or  $50\ \Omega\text{-F}$  whichever is smaller.

Class II (X7R, X5R, X6S, Y5V)

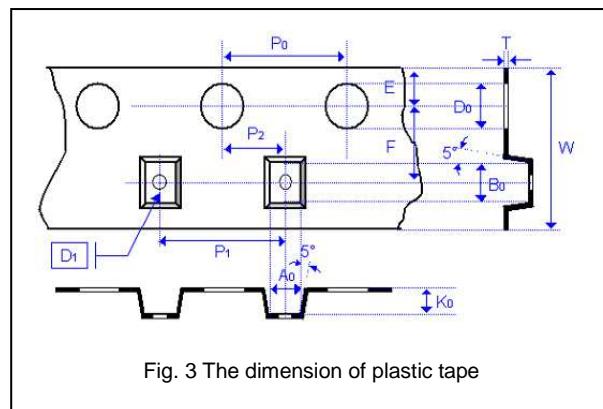
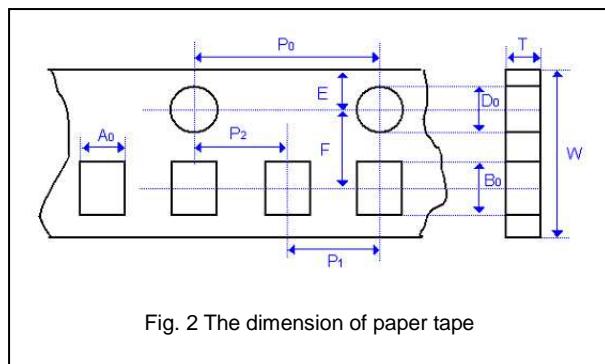
| Rated voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Insulation Resistance                                                  |
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| 100V: X7R<br>50V: $0402 \geq 0.1\mu\text{F}$ ; $0603 \geq 1\mu\text{F}$ ; $0805 \geq 1\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$ ; $1210 \geq 4.7\mu\text{F}$<br>35V: $0603 \geq 1\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$<br>25V: $0402 \geq 1\mu\text{F}$ ; $0603 \geq 2.2\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 10\mu\text{F}$ ; $1210 \geq 10\mu\text{F}$<br>16V: $0402 \geq 0.22\mu\text{F}$ ; $0603 \geq 1\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 10\mu\text{F}$ ; $1210 \geq 47\mu\text{F}$<br>10V: $0201 \geq 47\text{nF}$ ; $0402 \geq 0.47\mu\text{F}$ ; $0603 \geq 0.47\mu\text{F}$ ; $0805 \geq 2.2\mu\text{F}$ ; $1206 \geq 4.7\mu\text{F}$ ; $1210 \geq 47\mu\text{F}$<br>6.3V ; 4V | 1G $\Omega$ or $R_{xC} \geq 10\ \Omega\text{-F}$ whichever is smaller. |

| No                                                                                                                                                                             | Item                                                                                          | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Requirements                                                                                                                                                                                                                         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| 14                                                                                                                                                                             | Humidity (Damp Heat) Load                                                                     | <ul style="list-style-type: none"> <li>* Test temp.: <math>40 \pm 2^\circ\text{C}</math></li> <li>* Humidity: 90~95%RH</li> <li>* Test time: <math>500 + 24/-0</math> hrs.</li> <li>* To apply voltage : rated voltage.</li> <li>* Before initial measurement (Class II only): To apply test voltage for 1hr at <math>40^\circ\text{C}</math> and then set for <math>24 \pm 2</math> hrs at room temp.</li> <li>* Measurement to be made after keeping at room temp. for <math>24 \pm 2</math> hrs.</li> </ul> | <p>* No remarkable damage.<br/>         Cap change:<br/>         NPO: <math>\pm 7.5\%</math> or <math>0.75\mu\text{F}</math> whichever is larger.<br/>         X7R, X5R, X6S: <math>\geq 10\text{V}^{**}</math>, within <math>\pm 12.5\%</math>; <math>\leq 6.3\text{V}</math> within <math>\pm 25\%</math>;<br/>         TT series &amp; <math>C \geq 1\mu\text{F}</math>, within <math>\pm 25\%</math><br/> <math>**10\text{V}</math>: <math>0603 \geq 4.7\mu\text{F}</math>; <math>0402 \geq 1\mu\text{F}</math>; <math>0201 \geq 0.1\mu\text{F}</math>, within <math>\pm 25\%</math>;<br/> <math>Y5\text{V}</math>: <math>\geq 10\text{V}</math>, within <math>\pm 30\%</math>; <math>\leq 6.3\text{V}</math>, within <math>+30/-40\%</math><br/>         Q/D.F. value:<br/>         NPO: <math>C \geq 30\text{pF}</math>, <math>Q \geq 200</math>; <math>C &lt; 30\text{pF}</math>, <math>Q \geq 100 + 10/3C</math><br/>         X7R, X5R, X6S:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated</th> <th>D.F. <math>\leq</math></th> <th>Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td rowspan="2"><math>\geq 100\text{V}</math></td> <td><math>\leq 3\%</math></td> <td><math>\leq 6\%</math> 1206 <math>\geq 0.47\mu\text{F}</math><br/><math>\leq 7.5\%</math> 0805 <math>\geq 0.1\mu\text{F}</math>, 0603 <math>\geq 0.068\mu\text{F}</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td><math>\leq 6\%</math> 0201(50V); 0603 <math>\geq 0.047\mu\text{F}</math>; 0805 <math>\geq 0.18\mu\text{F}</math>; 1206 <math>\geq 0.47\mu\text{F}</math><br/><math>\leq 10\%</math> 1210 <math>\geq 4.7\mu\text{F}</math><br/><math>\leq 20\%</math> 0402 <math>\geq 0.1\mu\text{F}</math>; 0603 <math>\geq 1\mu\text{F}</math>; 0805 <math>\geq 1\mu\text{F}</math>; 1206 <math>\geq 2.2\mu\text{F}</math>; 1210 <math>\geq 10\mu\text{F}</math>; TT series</td> </tr> <tr> <td rowspan="5"><math>\geq 50\text{V}</math></td> <td><math>\leq 3\%</math></td> <td><math>\leq 10\%</math> 1210 <math>\geq 4.7\mu\text{F}</math><br/><math>\leq 20\%</math> 0402 <math>\geq 0.1\mu\text{F}</math>; 0603 <math>\geq 1\mu\text{F}</math>; 0805 <math>\geq 1\mu\text{F}</math>; 1206 <math>\geq 2.2\mu\text{F}</math>; 1210 <math>\geq 10\mu\text{F}</math>; TT series</td> </tr> <tr> <td><math>\leq 5\%</math></td> <td><math>\leq 20\%</math> 0603 <math>\geq 1\mu\text{F}</math>; 0805 <math>\geq 2.2\mu\text{F}</math>; 1210 <math>\geq 10\mu\text{F}</math><br/><math>\leq 10\%</math> 0201 <math>\geq 0.01\mu\text{F}</math>; 0805 <math>\geq 1\mu\text{F}</math>; 1210 <math>\geq 10\mu\text{F}</math><br/><math>\leq 14\%</math> 0603 <math>\geq 0.33\mu\text{F}</math>; 1206 <math>\geq 4.7\mu\text{F}</math><br/><math>\leq 15\%</math> 0402 <math>\geq 0.10\mu\text{F}</math>; 0603 <math>\geq 0.47\mu\text{F}</math>; 0805 <math>\geq 2.2\mu\text{F}</math>; 1206 <math>\geq 6.8\mu\text{F}</math>; 1210 <math>\geq 22\mu\text{F}</math>; TT series<br/><math>\leq 20\%</math> 0402 <math>\geq 1\mu\text{F}</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td><math>\leq 10\%</math> 0603 <math>\geq 0.15\mu\text{F}</math>; 0805 <math>\geq 0.68\mu\text{F}</math>; 1206 <math>\geq 2.2\mu\text{F}</math>; 1210 <math>\geq 4.7\mu\text{F}</math><br/><math>\leq 15\%</math> 0201 <math>\geq 0.01\mu\text{F}</math>; 0402 <math>\geq 0.033\mu\text{F}</math>; 0603 <math>\geq 0.68\mu\text{F}</math>; 0805 <math>\geq 2.2\mu\text{F}</math>; 1206 <math>\geq 4.7\mu\text{F}</math>; 1210 <math>\geq 22\mu\text{F}</math>; TT series</td> </tr> <tr> <td><math>\leq 7.5\%</math></td> <td><math>\leq 15\%</math> 0201 <math>\geq 0.012\mu\text{F}</math>; 0402 <math>\geq 0.33\mu\text{F}</math>; 0603 <math>\geq 0.33\mu\text{F}</math>; 0805 <math>\geq 2.2\mu\text{F}</math>; 1206 <math>\geq 2.2\mu\text{F}</math>; 1210 <math>\geq 22\mu\text{F}</math><br/><math>\leq 20\%</math> 0201 <math>\geq 0.1\mu\text{F}</math>; 0402 <math>\geq 1\mu\text{F}</math>; TT series</td> </tr> <tr> <td><math>\leq 15\%</math></td> <td><math>\leq 30\%</math> 0201 <math>\geq 0.1\mu\text{F}</math>; 0402 <math>\geq 1\mu\text{F}</math>; 0603 <math>\geq 10\mu\text{F}</math>; 0805 <math>\geq 4.7\mu\text{F}</math>; 1206 <math>\geq 47\mu\text{F}</math>; 1210 <math>\geq 100\mu\text{F}</math>; TT series</td> </tr> <tr> <td>4V</td> <td><math>\leq 20\%</math></td> <td>---</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th>Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td rowspan="2"><math>\geq 50\text{V}</math></td> <td><math>7.5\%</math></td> <td><math>10\%</math> 0603 <math>\geq 0.1\mu\text{F}</math>; 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0805 <math>\geq 3.3\mu\text{F}</math>; 1206 <math>\geq 10\mu\text{F}</math>; 1210 <math>\geq 22\mu\text{F}</math>; 1812 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td><math>20\%</math></td> <td>0603 <math>\geq 2.2\mu\text{F}</math>; 0805 <math>\geq 3.3\mu\text{F}</math>; 1206 <math>\geq 10\mu\text{F}</math>; 1210 <math>\geq 22\mu\text{F}</math>; 1812 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V</td> <td><math>20\%</math></td> <td><math>30\%</math> 0402 <math>\geq 0.47\mu\text{F}</math></td> </tr> <tr> <td>6.3V</td> <td><math>30\%</math></td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: <math>\geq 10\text{V}</math>, <math>500\text{M}\Omega</math> or <math>25\text{ }\Omega\text{-F}</math> whichever is smaller.<br/>         Class II (X7R, X5R, X6S, Y5V)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7" style="vertical-align: middle; 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0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 4.7\mu\text{F}$ ; 1206 $\geq 47\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$ ; TT series | 4V | $\leq 20\%$ | --- | Rated vol. | D.F. $\leq$ | Exception of D.F. $\leq$ | $\geq 50\text{V}$ | $7.5\%$ | $10\%$ 0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.47\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ | $10\%$ | --- | 25V | $7.5\%$ | $10\%$ 0402 $\geq 0.047\mu\text{F}$ ; 0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.33\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$ | $15\%$ | 0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ | $10\%$ | $12.5\%$ 0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.68\mu\text{F}$<br>$20\%$ 0402 $\geq 0.22\mu\text{F}$ | 16V<br>( $C < 1.0\mu\text{F}$ ) | $12.5\%$ | $20\%$ 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 3.3\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ ; 1812 $\geq 47\mu\text{F}$ | $20\%$ | 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 3.3\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ ; 1812 $\geq 47\mu\text{F}$ | 10V | $20\%$ | $30\%$ 0402 $\geq 0.47\mu\text{F}$ | 6.3V | $30\%$ | --- | Rated voltage | Insulation Resistance | 100V: X7R | $500\text{M}\Omega$ or<br>$R \times C \geq 5\text{ }\Omega\text{-F}$<br>whichever is smaller. | 50V: 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$ | 35V: 0805 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$ | 25V: 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$ | 16V: 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$ | 10V: 0201 $\geq 47\text{nF}$ ; 0402 $\geq 0.47\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$ | 6.3V ; 4V |  |  |  |
| Rated                                                                                                                                                                          | D.F. $\leq$                                                                                   | Exception of D.F. $\leq$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                      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                                             |                                                             |                                                                                                                                                 |                                                                                                                                                  |                                                                                                                                                                                |           |  |  |  |
| $\geq 100\text{V}$                                                                                                                                                             | $\leq 3\%$                                                                                    | $\leq 6\%$ 1206 $\geq 0.47\mu\text{F}$<br>$\leq 7.5\%$ 0805 $\geq 0.1\mu\text{F}$ , 0603 $\geq 0.068\mu\text{F}$                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                      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| 100V: X7R                                                                                                                                                                      | $500\text{M}\Omega$ or<br>$R \times C \geq 5\text{ }\Omega\text{-F}$<br>whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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| 50V: 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$                                                             |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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| 35V: 0805 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$                                                                                                                    |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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| 25V: 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$                                |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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| 16V: 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$                               |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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| 10V: 0201 $\geq 47\text{nF}$ ; 0402 $\geq 0.47\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$ |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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| 6.3V ; 4V                                                                                                                                                                      |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                      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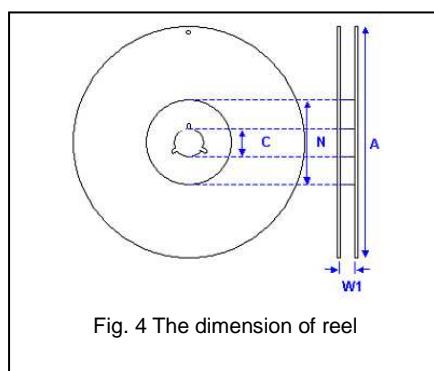
| No                                                                                                                                                                               | Item                                                                     | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|--|--|
| 15.                                                                                                                                                                              | High Temperature Load (Endurance)                                        | * Test temp. :<br>NP0, X7R/X7E: $125 \pm 3^\circ\text{C}$<br>X6S: $105 \pm 3^\circ\text{C}$<br>X5R, Y5V: $85 \pm 3^\circ\text{C}$<br>* Test time: $1000 \times 24 \times 0$ hrs.<br>To apply voltage:<br>(1) $\leq 6.3\text{V}$ or $C \geq 10\mu\text{F}$ :<br>150% of rated voltage.<br>(2) $10\text{V} \leq U_r < 500\text{V}$ :<br>200% of rated voltage.<br>(3) 500V: 150% of rated voltage.<br>(4) $U_r \geq 630\text{V}$ :<br>120% of rated voltage.<br>(5) 100% of rated voltage for below range.<br><table border="1"> <thead> <tr> <th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr> </thead> <tbody> <tr> <td>0201</td><td>X5R/X7R/X6S</td><td>6.3V, 10V</td><td><math>C \geq 0.1\mu\text{F}</math></td></tr> <tr> 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4.7\mu\text{F}</math></td></tr> <tr> <td>2220</td><td>X7R</td><td>100V</td><td><math>C \geq 6.8\mu\text{F}</math></td></tr> </tbody> </table><br>*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for $24 \pm 2$ hrs at room temp. | Size                                            | Dielectric | Rated voltage | Capacitance | 0201 | X5R/X7R/X6S | 6.3V, 10V | $C \geq 0.1\mu\text{F}$ | 0402 | X5R/X7R/X6S | 6.3V, 10V | $C \geq 1.0\mu\text{F}$ |  |  | 4V | $C \geq 22\mu\text{F}$ | 0603 | X5R/X7R/X6S | 6.3V, 10V | $C \geq 4.7\mu\text{F}$ |  |  | 35V | $C \geq 1.0\mu\text{F}$ | 0805 | X5R/X7R/X6S | 4V, 6.3V | $C \geq 47\mu\text{F}$ , $C \geq 22\mu\text{F}$ | 1206 | X5R/X7R/ | 6.3V | $C \geq 47\mu\text{F}$ | TT18 | Y5V | 6.3V, 10V | $C \geq 2.2\mu\text{F}$ | TT21 | Y5V | 6.3V | $C \geq 10\mu\text{F}$ | TT31 | Y5V | 6.3V | $C \geq 22\mu\text{F}$ | Size | Dielectric | Rated voltage | Capacitance range | 0201 | X5R/X7R/X6S | 16V | $C \geq 0.1\mu\text{F}$ | 0402 | X5R/X7R/X6S | 50V | $C \geq 0.1\mu\text{F}$ |  |  | 10V~25V | $C \geq 0.22\mu\text{F}$ |  | Y5V | 16V | $C \geq 0.47\mu\text{F}$ | 0603 | X5R/X7R/X6S | 10V, 50V | $C \geq 1.0\mu\text{F}$ |  | Y5V | 16V | $C \geq 2.2\mu\text{F}$ | 0805 | X5R/X7R/X6S | 10~50V | $C \geq 4.7\mu\text{F}$ |  | X7R | 50V | $C \geq 2.2\mu\text{F}$ |  |  | 100V | $C \geq 0.47\mu\text{F}$ |  | Y5V | 16V | $C \geq 4.7\mu\text{F}$ | 2220 | X7R | 100V | $C \geq 6.8\mu\text{F}$ | * No remarkable damage.<br>Cap change:<br>NP0: $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger<br>X7R, X5R, X6S: $\geq 10\text{V}^{**}$ , within $\pm 12.5\%$ ; $\leq 6.3\text{V}$ within $\pm 25\%$ ; TT series & $C \geq 1\mu\text{F}$ , within $\pm 25\%$<br>**10V: 0603 $\geq 4.7\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0201 $\geq 0.1\mu\text{F}$ , within $\pm 25\%$ ; Y5V: $\geq 10\text{V}$ , within $\pm 30\%$ ; $\leq 6.3\text{V}$ , within $+30/-40\%$<br>Q/D.F. value:<br>NP0: More than $30\text{pF}$ , $Q \geq 350$<br>$10\text{pF} \leq C < 30\text{pF}$ , $Q \geq 275+2.5\text{C}$<br>Less than $10\text{pF}$ , $Q \geq 200+10\text{C}$<br>X7R, X5R, X6S:<br><table border="1"> <thead> <tr> <th>Rated</th><th>D.F. <math>\leq</math></th><th>Exception of D.F. <math>\leq</math></th></tr> </thead> <tbody> <tr> <td><math>\geq 100\text{V}</math></td><td><math>\leq 3\%</math></td><td><math>\leq 6\% 1206 \geq 0.47\mu\text{F}</math><br/><math>\leq 7.5\% 0805 \geq 0.1\mu\text{F}</math>, 0603 <math>\geq 0.068\mu\text{F}</math></td></tr> <tr> <td><math>\geq 50\text{V}</math></td><td><math>\leq 3\%</math></td><td><math>\leq 6\% 0201(50\text{V})</math>, 0603 <math>\geq 0.047\mu\text{F}</math>, 0805 <math>\geq 0.18\mu\text{F}</math>, 1206 <math>\geq 0.47\mu\text{F}</math><br/><math>\leq 10\% 1210 \geq 4.7\mu\text{F}</math><br/><math>\leq 20\% 0402 \geq 0.1\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 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<math>\geq 0.033\mu\text{F}</math>, 0603 <math>\geq 0.68\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 22\mu\text{F}</math>, TT series</td></tr> <tr> <td>16V</td><td><math>\leq 5\%</math></td><td><math>\leq 15\% 0201 \geq 0.012\mu\text{F}</math>, 0402 <math>\geq 0.33\mu\text{F}</math>, 0603 <math>\geq 0.33\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 22\mu\text{F}</math><br/><math>\leq 20\% 0201 \geq 0.1\mu\text{F}</math>, 0402 <math>\geq 1\mu\text{F}</math>, TT series</td></tr> <tr> <td>10V</td><td><math>\leq 7.5\%</math></td><td><math>\leq 15\% 0201 \geq 0.012\mu\text{F}</math>, 0402 <math>\geq 0.33\mu\text{F}</math>, 0603 <math>\geq 0.33\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 22\mu\text{F}</math><br/><math>\leq 20\% 0201 \geq 0.1\mu\text{F}</math>, 0402 <math>\geq 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0.47\mu\text{F}$<br>$\leq 7.5\% 0805 \geq 0.1\mu\text{F}$ , 0603 $\geq 0.068\mu\text{F}$ | $\geq 50\text{V}$ | $\leq 3\%$ | $\leq 6\% 0201(50\text{V})$ , 0603 $\geq 0.047\mu\text{F}$ , 0805 $\geq 0.18\mu\text{F}$ , 1206 $\geq 0.47\mu\text{F}$<br>$\leq 10\% 1210 \geq 4.7\mu\text{F}$<br>$\leq 20\% 0402 \geq 0.1\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$ , TT series | 35V | $\leq 5\%$ | $\leq 20\% 0603 \geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$<br>$\leq 10\% 0201 \geq 0.01\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$<br>$\leq 14\% 0603 \geq 0.33\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$<br>$\leq 15\% 0402 \geq 0.10\mu\text{F}$ , 0603 $\geq 0.47\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 6.8\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$ , TT series | 25V | $\leq 5\%$ | $\leq 20\% 0402 \geq 1\mu\text{F}$<br>$\leq 10\% 0603 \geq 0.15\mu\text{F}$ , 0805 $\geq 0.68\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 4.7\mu\text{F}$<br>$\leq 15\% 0201 \geq 0.01\mu\text{F}$ , 0402 $\geq 0.033\mu\text{F}$ , 0603 $\geq 0.68\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$ , TT series | 16V | $\leq 5\%$ | $\leq 15\% 0201 \geq 0.012\mu\text{F}$ , 0402 $\geq 0.33\mu\text{F}$ , 0603 $\geq 0.33\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$<br>$\leq 20\% 0201 \geq 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , TT series | 10V | $\leq 7.5\%$ | $\leq 15\% 0201 \geq 0.012\mu\text{F}$ , 0402 $\geq 0.33\mu\text{F}$ , 0603 $\geq 0.33\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$<br>$\leq 20\% 0201 \geq 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , TT series | 6.3V | $\leq 15\%$ | $\leq 30\% 0201 \geq 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , 0603 $\geq 10\mu\text{F}$ , 0805 $\geq 4.7\mu\text{F}$ , 1206 $\geq 47\mu\text{F}$ , 1210 $\geq 100\mu\text{F}$ , TT series | 4V | $\leq 20\%$ | --- | Rated vol. | D.F. $\leq$ | Exception of D.F. $\leq$ | $\geq 50\text{V}$ | 7.5% | 10% $0603 \geq 0.1\mu\text{F}$ , 0805 $\geq 0.47\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ | 35V | 10% | --- | 25V | 7.5% | 10% $0402 \geq 0.047\mu\text{F}$ , 0603 $\geq 0.1\mu\text{F}$ , 0805 $\geq 0.33\mu\text{F}$ , 1206 $\geq 1\mu\text{F}$ , 1210 $\geq 4.7\mu\text{F}$<br>15% $0402 \geq 0.068\mu\text{F}$ , 0603 $\geq 0.47\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$ | 16V | ( $C < 1.0\mu\text{F}$ ) 10% | 12.5% $0402 \geq 0.068\mu\text{F}$ , 0603 $\geq 0.68\mu\text{F}$<br>20% $0402 \geq 0.22\mu\text{F}$ | 16V ( $C \geq 1.0\mu\text{F}$ ) | 12.5% | 20% $0603 \geq 2.2\mu\text{F}$ , 0805 $\geq 3.3\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$ , 1812 $\geq 47\mu\text{F}$ | 10V | 20% | 30% $0402 \geq 0.47\mu\text{F}$ | 6.3V | 30% | --- | *I.R.: $\geq 10\text{V}$ , $1\text{G}\Omega$ or $50\text{ }\Omega\text{-F}$ whichever is smaller.<br>Class II (X7R, X5R, X6S, Y5V) | <table border="1"> <thead> <tr> <th>Rated voltage</th><th>Insulation Resistance</th></tr> </thead> <tbody> <tr> <td>100V: X7R</td><td rowspan="6">1GΩ or <math>R \times C \geq 10\text{ }\Omega\text{-F}</math> whichever is smaller.</td></tr> <tr> <td>50V: 0402 <math>\geq 0.1\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 4.7\mu\text{F}</math></td></tr> <tr> <td>35V: 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td></tr> <tr> <td>25V: 0402 <math>\geq 1\mu\text{F}</math>, 0603 <math>\geq 2.2\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td></tr> <tr> <td>16V: 0402 <math>\geq 0.22\mu\text{F}</math>, 0603 <math>\geq 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| Size                                                                                                                                                                             | Dielectric                                                               | Rated voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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| 0201                                                                                                                                                                             | X5R/X7R/X6S                                                              | 6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $C \geq 0.1\mu\text{F}$                         |            |               |             |      |             |           |                         |      |             |           |                         |  |  |    |                        |      |             |           |                         |  |  |     |                         |      |             |          |                                                 |      |          |      |                        |      |     |           |                         |      |     |      |                        |      |     |      |                        |      |            |               |                   |      |             |     |                         |      |             |     | 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| 0402                                                                                                                                                                             | X5R/X7R/X6S                                                              | 6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $C \geq 1.0\mu\text{F}$                         |            |               |             |      |             |           |                         |      |             |           |                         |  |  |    |                        |      |             |           |                         |  |  |     |                         |      |             |          |                                                 |      |          |      |                        |      |     |           |                         |      |     |      |                        |      |     |      |                        |      |            |               |                   |      |             |     |                         |      |             |     | 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|                                                                                                                                                                                  |                                                                          | 4V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | $C \geq 22\mu\text{F}$                          |            |               |             |      |             |           |                         |      |             |           |                         |  |  |    |                        |      |             |           |                         |  |  |     |                         |      |             |          |                                                 |      |          |      |                        |      |     |           |                         |      |     |      |                        |      |     |      |                        |      |            |               |                   |      |             |     |                         |      |             |     | 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| 0603                                                                                                                                                                             | X5R/X7R/X6S                                                              | 6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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| $\geq 100\text{V}$                                                                                                                                                               | $\leq 3\%$                                                               | $\leq 6\% 1206 \geq 0.47\mu\text{F}$<br>$\leq 7.5\% 0805 \geq 0.1\mu\text{F}$ , 0603 $\geq 0.068\mu\text{F}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| $\geq 50\text{V}$                                                                                                                                                                | $\leq 3\%$                                                               | $\leq 6\% 0201(50\text{V})$ , 0603 $\geq 0.047\mu\text{F}$ , 0805 $\geq 0.18\mu\text{F}$ , 1206 $\geq 0.47\mu\text{F}$<br>$\leq 10\% 1210 \geq 4.7\mu\text{F}$<br>$\leq 20\% 0402 \geq 0.1\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$ , TT series                                                                                                                                                                                                                                                                                                                                                                                                                                        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| 35V                                                                                                                                                                              | $\leq 5\%$                                                               | $\leq 20\% 0603 \geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$<br>$\leq 10\% 0201 \geq 0.01\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$<br>$\leq 14\% 0603 \geq 0.33\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$<br>$\leq 15\% 0402 \geq 0.10\mu\text{F}$ , 0603 $\geq 0.47\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 6.8\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$ , TT series                                                                                                                                                                                                                                                                                                                               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| 25V                                                                                                                                                                              | $\leq 5\%$                                                               | $\leq 20\% 0402 \geq 1\mu\text{F}$<br>$\leq 10\% 0603 \geq 0.15\mu\text{F}$ , 0805 $\geq 0.68\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 4.7\mu\text{F}$<br>$\leq 15\% 0201 \geq 0.01\mu\text{F}$ , 0402 $\geq 0.033\mu\text{F}$ , 0603 $\geq 0.68\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$ , TT series                                                                                                                                                                                                                                                                                                                                                                                              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| 16V                                                                                                                                                                              | $\leq 5\%$                                                               | $\leq 15\% 0201 \geq 0.012\mu\text{F}$ , 0402 $\geq 0.33\mu\text{F}$ , 0603 $\geq 0.33\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$<br>$\leq 20\% 0201 \geq 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , TT series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 10V                                                                                                                                                                              | $\leq 7.5\%$                                                             | $\leq 15\% 0201 \geq 0.012\mu\text{F}$ , 0402 $\geq 0.33\mu\text{F}$ , 0603 $\geq 0.33\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 22\mu\text{F}$<br>$\leq 20\% 0201 \geq 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , TT series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 6.3V                                                                                                                                                                             | $\leq 15\%$                                                              | $\leq 30\% 0201 \geq 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , 0603 $\geq 10\mu\text{F}$ , 0805 $\geq 4.7\mu\text{F}$ , 1206 $\geq 47\mu\text{F}$ , 1210 $\geq 100\mu\text{F}$ , TT series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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| 50V: 0402 $\geq 0.1\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 4.7\mu\text{F}$                                  |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 35V: 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$                                                                                           |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 25V: 0402 $\geq 1\mu\text{F}$ , 0603 $\geq 2.2\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$                                  |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 16V: 0402 $\geq 0.22\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 47\mu\text{F}$                                 |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 10V: 0201 $\geq 47\mu\text{F}$ , 0402 $\geq 0.47\mu\text{F}$ , 0603 $\geq 0.47\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 47\mu\text{F}$ |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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                        |  |  |         |                          |  |     |     |                          |      |             |          |                         |  |     |     |                         |      |             |        |                         |  |     |     |                         |  |  |      |                          |  |     |     |                         |      |     |      |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                                                                                             |           |  |  |  |

## APPENDIXES

### □ Tape & reel dimensions

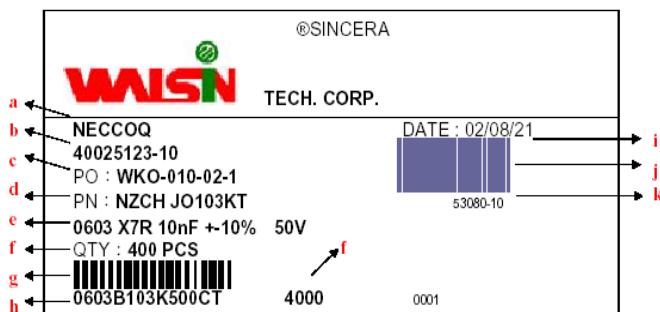


| Size                    | 0402      | 0603      | 0805      |           |           | 1206      |           |           | 1210       |           | 1812      |
|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|
| Thickness               | E         | S, X      | A         | B         | C, D, I   | B         | C, J, D   | G         | C, D, G    | M         | D, K      |
| <b>A<sub>0</sub></b>    | 0.70±0.10 | 1.02±0.05 | 1.50±0.10 | 1.50±0.10 | <1.57     | 2.00±0.10 | <1.85     | <1.95     | <2.97      | <2.97     | <3.81     |
| <b>B<sub>0</sub></b>    | 1.20±0.10 | 1.80±0.05 | 2.30±0.10 | 2.30±0.10 | <2.40     | 3.50±0.10 | <3.46     | <3.67     | <3.73      | <3.73     | <5.30     |
| <b>T</b>                | 0.70±0.10 | 0.95±0.05 | 0.75±0.05 | 0.95±0.05 | 0.23±0.05 | 0.95±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05  | 0.23±0.05 | 0.25±0.05 |
| <b>K<sub>0</sub></b>    | -         | -         | -         | -         | <2.50     | -         | <2.50     | <2.50     | <2.50      | <3.00     | <2.50     |
| <b>W</b>                | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10  | 8.00±0.10 | 12.0±0.20 |
| <b>P<sub>0</sub></b>    | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.100 | 4.00±0.10 | 4.00±0.10 |
| <b>10xP<sub>0</sub></b> | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10  | 40.0±0.10 | 40.0±0.10 |
| <b>P<sub>1</sub></b>    | 2.00±0.05 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10  | 4.00±0.10 | 8.00±0.10 |
| <b>P<sub>2</sub></b>    | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05  | 2.00±0.05 | 2.00±0.05 |
| <b>D<sub>0</sub></b>    | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05  | 1.50±0.05 | 1.50±0.05 |
| <b>D<sub>1</sub></b>    | -         | -         | -         | -         | 1.00±0.10 | -         | 1.00±0.10 | 1.00±0.10 | 1.00±0.10  | 1.00±0.10 | 1.50±0.10 |
| <b>E</b>                | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10  | 1.75±0.10 | 1.75±0.10 |
| <b>F</b>                | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05  | 3.50±0.05 | 5.50±0.05 |



| Size                 | 0402, 0603, 0805, 1206, 1210 |               |               | 1812          |
|----------------------|------------------------------|---------------|---------------|---------------|
| Reel size            | 7"                           | 10"           | 13"           | 7"            |
| <b>C</b>             | 13.0+0.5/-0.2                | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 |
| <b>W<sub>1</sub></b> | 8.4+1.5/-0                   | 8.4+1.5/-0    | 8.4+1.5/-0    | 12.4+2.0/-0   |
| <b>A</b>             | 178.0±0.10                   | 250.0±1.0     | 330.0±1.0     | 178.0±0.10    |
| <b>N</b>             | 60.0+1.0/-0                  | 100.0±1.0     | 100±1.0       | 60.0+1.0/-0   |

□ Description of customer label



- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

□ Constructions

| No. | Name             | NPO, X7R, X5R, Y5V       |
|-----|------------------|--------------------------|
| ①   | Ceramic material | BaTiO <sub>3</sub> based |
| ②   | Inner electrode  | Ni                       |
| ③   | Inner layer      | Cu                       |
| ④   | Termination      | Ni                       |
| ⑤   | Outer layer      | Sn                       |

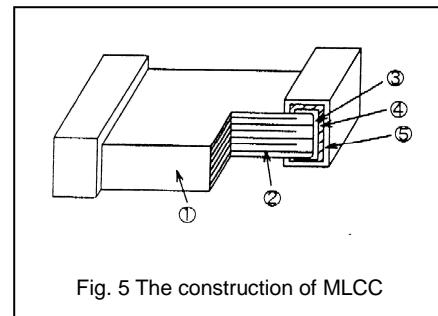


Fig. 5 The construction of MLCC

□ Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

## □ 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.

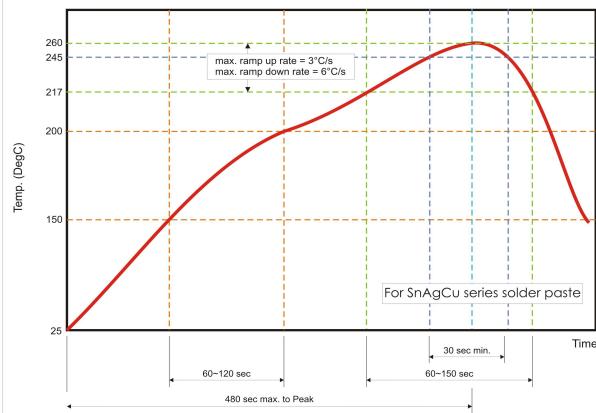


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

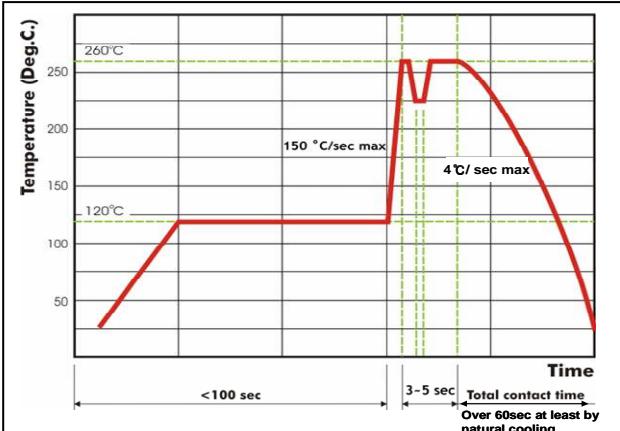


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.