# APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination Series

(SG_6.3V to 2000V)

X7R Dielectric

0603 to 1206 Sizes

Halogen Free & 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. Power supply and related industries.
b. Lighting industry.
c. The other mechanical stress concerned products.

## 4. HOW TO ORDER

| SG | 31 | B | 104 | K | 500 | C | T |
|---|---|---|---|---|---|---|---|
| **Series** | **Size** | **Dielectric** | **Capacitance** | **Tolerance** | **Rated voltage** | **Termination** | **Packaging** |
| **SG**=Soft termination | **18**=0603 (1608)<br>**21**=0805 (2012)<br>**31**=1206 (3216) | **B**=X7R | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br>Eg.<br>104=10x10$^4$<br>=100nF | **J**=±5%<br>**K**=±10%<br>**M**=±20% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>**6R3**=6.3 VDC<br>**100**=10 VDC<br>**160**=16 VDC<br>**250**=25 VDC<br>**500**=50 VDC<br>**101**=100 VDC<br>**201**=200 VDC<br>**251**=250 VDC<br>**401**=400 VDC<br>**451**=450 VDC<br>**501**=500 VDC<br>**631**=630 VDC<br>**102**=1000 VDC<br>**152**=1500 VDC<br>**202**=2000 VDC | **C**=Cu Polymer /Ni/Sn | **T**=7" reeled<br>**G**=13" reeled |

## 5. EXTERNAL DIMENSIONS & CONSTRUCTIONS

| Size Inch (mm) | L (mm) | W (mm) | T (mm)/Symbol | | Remark | $M_B$ (mm) |
|---|---|---|---|---|---|---|
| 0603 (1608) | 1.60±0.20 | 0.80±0.10 | 0.80±0.07 | S | | 0.40±0.15 |
| | 1.60±0.30 | 0.80±0.30 | 0.80±0.30 | 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±0.30 | 1.25±0.30 | 1.25±0.30 | I | # | |
| 1206 (3216) | 3.20+0.4/-0.1 | 1.60±0.15 | 0.80±0.10 | B | | 0.60±0.20 (0.5±0.25)* |
| | | | 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±0.50 | 1.60±0.50 | 1.60±0.50 | P | # | |

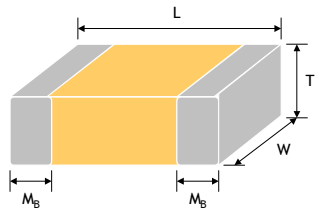


Fig. 1 The outline of MLCC

# Reflow soldering only is recommended.

* For 1206_≧1000V products.



## 6. GENERAL ELECTRICAL DATA

| | |
|---|---|
| **Dielectric** | X7R |
| **Size** | 0603, 0805, 1206 |
| **Capacitance range*** | 100pF to 10μF |
| **Capacitance tolerance**** | J (±5%), K (±10%), M (±20%) |
| **Rated voltage (WVDC)** | 6.3V to 2000V |
| **Operating temperature** | -55 to +125℃ |
| **Capacitance characteristic** | ±15% |
| **Termination** | 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℃ at ambient temperature

X7R, X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25℃ am bient temperature.

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

# 7. CAPACITANCE RANGE

## X7R Dielectric 0402, 0603 Sizes

| DIELECTRIC | | X7R | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SIZE | | 0603 | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance | 100pF (101) | S | S | S | S | S | X | X |
| | 120pF (121) | S | S | S | S | S | X | X |
| | 150pF (151) | S | S | S | S | S | X | X |
| | 180pF (181) | S | S | S | S | S | X | X |
| | 220pF (221) | S | S | S | S | S | X | X |
| | 270pF (271) | S | S | S | S | S | X | X |
| | 330pF (331) | S | S | S | S | S | X | X |
| | 390pF (391) | S | S | S | S | S | X | X |
| | 470pF (471) | S | S | S | S | S | X | X |
| | 560pF (561) | S | S | S | S | S | X | X |
| | 680pF (681) | S | S | S | S | S | X | X |
| | 820pF (821) | S | S | S | S | S | X | X |
| | 1,000pF (102) | S | S | S | S | S | X | X |
| | 1,200pF (122) | S | S | S | S | S | X | X |
| | 1,500pF (152) | S | S | S | S | S | X | X |
| | 1,800pF (182) | S | S | S | S | S | X | X |
| | 2,200pF (222) | S | S | S | S | S | X | X |
| | 2,700pF (272) | S | S | S | S | S | X | X |
| | 3,300pF (332) | S | S | S | S | S | X | X |
| | 3,900pF (392) | S | S | S | S | S | X | X |
| | 4,700pF (472) | S | S | S | S | S | X | X |
| | 5,600pF (562) | S | S | S | S | S | X | X |
| | 6,800pF (682) | S | S | S | S | S | X | X |
| | 8,200pF (822) | S | S | S | S | S | X | X |
| | 0.010μF (103) | S | S | S | S | S | X | X |
| | 0.012μF (123) | S | S | S | S | X | | |
| | 0.015μF (153) | S | S | S | S | X | | |
| | 0.018μF (183) | S | S | S | S | X | | |
| | 0.022μF (223) | S | S | S | S | X | | |
| | 0.027μF (273) | S | S | S | S | X | | |
| | 0.033μF (333) | S | S | S | X | X | | |
| | 0.039μF (393) | S | S | S | X | X | | |
| | 0.047μF (473) | S | S | S | X | X | | |
| | 0.056μF (563) | S | S | S | X | X | | |
| | 0.068μF (683) | S | S | S | X | X | | |
| | 0.082μF (823) | S | S | S | X | X | | |
| | 0.10μF (104) | S | S | S | X | X | | |
| | 0.12μF (124) | S | S | X | | | | |
| | 0.15μF (154) | S | S | X | | | | |
| | 0.18μF (184) | S | S | X | | | | |
| | 0.22μF (224) | S | S | X | X | | | |
| | 0.27μF (274) | X | X | X | | | | |
| | 0.33μF (334) | X | X | X | | | | |
| | 0.39μF (394) | X | X | X | | | | |
| | 0.47μF (474) | X | X | X | | | | |
| | 0.56μF (564) | X | X | | | | | |
| | 0.68μF (684) | X | X | | | | | |
| | 0.82μF (824) | X | X | | | | | |
| | 1.0μF (105) | X | X | X | | | | |
| | 1.5μF (155) | | | | | | | |
| | 2.2μF (225) | | | | | | | |
| | 4.7μF (475) | | | | | | | |

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.

## X7R Dielectric 0805 Size

| DIELECTRIC | | X7R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0805 | | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance | 100pF (101) | D | D | D | D | D | D | D | B | B | B |
| | 120pF (121) | D | D | D | D | D | D | D | B | B | B |
| | 150pF (151) | D | D | D | D | D | D | D | B | B | B |
| | 180pF (181) | D | D | D | D | D | D | D | B | B | B |
| | 220pF (221) | D | D | D | D | D | D | D | B | B | B |
| | 270pF (271) | D | D | D | D | D | D | D | B | B | B |
| | 330pF (331) | D | D | D | D | D | D | D | B | B | B |
| | 390pF (391) | D | D | D | D | D | D | D | B | B | B |
| | 470pF (471) | D | D | D | D | D | D | D | B | B | B |
| | 560pF (561) | D | D | D | D | D | D | D | B | B | B |
| | 680pF (681) | D | D | D | D | D | D | D | B | B | B |
| | 820pF (821) | D | D | D | D | D | D | D | B | B | B |
| | 1,000pF (102) | D | D | D | D | D | D | D | B | B | B |
| | 1,200pF (122) | D | D | D | D | D | D | D | B | B | B |
| | 1,500pF (152) | D | D | D | D | D | D | D | B | B | D |
| | 1,800pF (182) | D | D | D | D | D | D | D | B | B | D |
| | 2,200pF (222) | D | D | D | D | D | D | D | B | B | D |
| | 2,700pF (272) | D | D | D | D | D | D | D | B | B | |
| | 3,300pF (332) | D | D | D | D | D | D | D | B | B | |
| | 3,900pF (392) | D | D | D | D | D | D | D | B | B | |
| | 4,700pF (472) | D | D | D | D | D | D | D | D | D | |
| | 5,600pF (562) | D | D | D | D | D | D | D | D | D | |
| | 6,800pF (682) | D | D | D | D | D | D | D | D | D | |
| | 8,200pF (822) | D | D | D | D | D | D | D | D | D | |
| | 0.010μF (103) | D | D | D | D | D | D | D | D | D | |
| | 0.012μF (123) | D | D | D | D | D | D | D | D | D | |
| | 0.015μF (153) | D | D | D | D | D | D | D | D | D | |
| | 0.018μF (183) | D | D | D | D | D | D | D | D | D | |
| | 0.022μF (223) | D | D | D | D | D | D | D | D | D | |
| | 0.027μF (273) | D | D | D | D | D | D | D | D | D | |
| | 0.033μF (333) | D | D | D | D | D | D | D | D | | |
| | 0.039μF (393) | D | D | D | D | D | D | D | | | |
| | 0.047μF (473) | D | D | D | D | D | D | D | | | |
| | 0.056μF (563) | D | D | D | D | D | D | D | | | |
| | 0.068μF (683) | D | D | D | D | D | D | D | | | |
| | 0.082μF (823) | D | D | D | D | D | D | | | | |
| | 0.10μF (104) | D | D | D | D | D | D | | | | |
| | 0.12μF (124) | D | D | D | D | I | | | | | |
| | 0.15μF (154) | D | D | D | D | I | | | | | |
| | 0.18μF (184) | D | D | D | D | I | | | | | |
| | 0.22μF (224) | D | D | D | D | I | | | | | |
| | 0.27μF (274) | I | I | I | I | | | | | | |
| | 0.33μF (334) | I | I | I | I | | | | | | |
| | 0.39μF (394) | I | I | I | I | | | | | | |
| | 0.47μF (474) | I | I | I | I | | | | | | |
| | 0.56μF (564) | I | I | I | | | | | | | |
| | 0.68μF (684) | I | I | I | | | | | | | |
| | 0.82μF (824) | I | I | I | | | | | | | |
| | 1.0μF (105) | I | I | I | I | | | | | | |
| | 1.5μF (155) | I | I | I | | | | | | | |
| | 2.2μF (225) | I | I | I | | | | | | | |
| | 3.3μF (335) | | | | | | | | | | |
| | 4.7μF (475) | | | | | | | | | | |
| | 10μF (106) | | | | | | | | | | |
| | 22μF (226) | | | | | | | | | | |
| | 47μF (476) | | | | | | | | | | |

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.

## X7R Dielectric 1206 Size

| DIELECTRIC | | X7R | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1206 | | | | | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 400 | 450 | 500 | 630 | 1000 | 1500 | 2000 |
| Capacitance | 100pF (101) | | | | | | D | D | | | D | D | D | D | D |
| | 120pF (121) | | | | | | D | D | | | D | D | D | D | D |
| | 150pF (151) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 180pF (181) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 220pF (221) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 270pF (271) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 330pF (331) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 390pF (391) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 470pF (471) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 560pF (561) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 680pF (681) | D | D | D | D | D | D | D | | | D | D | D | D | D |
| | 820pF (821) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 1,000pF (102) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 1,200pF (122) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 1,500pF (152) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 1,800pF (182) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 2,200pF (222) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 2,700pF (272) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 3,300pF (332) | D | D | D | D | D | D | D | | | D | D | D | G | G |
| | 3,900pF (392) | D | D | D | D | D | D | D | | | D | D | D | G | |
| | 4,700pF (472) | D | D | D | D | D | D | D | | | D | D | D | G | |
| | 5,600pF (562) | D | D | D | D | D | D | D | | | D | D | D | G | |
| | 6,800pF (682) | D | D | D | D | D | D | D | | | D | D | D | G | |
| | 8,200pF (822) | D | D | D | D | D | D | D | | | D | D | D | G | |
| | 0.010μF (103) | D | D | D | D | D | D | D | | | D | D | D | G | |
| | 0.012μF (123) | D | D | D | D | D | D | D | | | D | D | G | | |
| | 0.015μF (153) | D | D | D | D | D | D | D | | | D | D | G | | |
| | 0.018μF (183) | D | D | D | D | D | D | D | | | D | D | | | |
| | 0.022μF (223) | D | D | D | D | D | D | D | | | G | G | | | |
| | 0.027μF (273) | D | D | D | D | D | D | D | | | G | G | | | |
| | 0.033μF (333) | D | D | D | D | D | G | G | | | G | G | | | |
| | 0.039μF (393) | D | D | D | D | D | G | G | | | G | G | | | |
| | 0.047μF (473) | D | D | D | D | D | G | G | | | G | G | | | |
| | 0.056μF (563) | D | D | D | D | D | G | G | | | G | G | | | |
| | 0.068μF (683) | D | D | D | D | D | G | G | G | G | | | | | |
| | 0.082μF (823) | D | D | D | D | D | G | G | G | G | | | | | |
| | 0.10μF (104) | D | D | D | D | D | G | G | G | G | | | | | |
| | 0.12μF (124) | D | D | D | D | D | | | | | | | | | |
| | 0.15μF (154) | C | C | C | C | G | | | | | | | | | |
| | 0.18μF (184) | C | C | C | C | G | | | | | | | | | |
| | 0.22μF (224) | C | C | C | C | G | | | | | | | | | |
| | 0.27μF (274) | C | C | C | D | G | | | | | | | | | |
| | 0.33μF (334) | C | C | C | D | G | | | | | | | | | |
| | 0.39μF (394) | C | C | J | P | G | | | | | | | | | |
| | 0.47μF (474) | J | J | J | P | G | | | | | | | | | |
| | 0.56μF (564) | J | J | J | P | P | | | | | | | | | |
| | 0.68μF (684) | J | J | J | P | P | | | | | | | | | |
| | 0.82μF (824) | J | J | J | P | P | | | | | | | | | |
| | 1.0μF (105) | J | J | J | P | | | | | | | | | | |
| | 1.5μF (155) | J | J | P | | | | | | | | | | | |
| | 2.2μF (225) | J | J | P | | | | | | | | | | | |
| | 3.3μF (335) | P | P | P | | | | | | | | | | | |
| | 4.7μF (475) | P | P | P | | | | | | | | | | | |
| | 10μF (106) | P | | | | | | | | | | | | | |
| | 22μF (226) | | | | | | | | | | | | | | |
| | 47μF (476) | | | | | | | | | | | | | | |

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±0.30 | 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 | 10k |
| | 1.25±0.30 | I | - | - | 3k | 10k |
| 1206 (3216) | 0.80±0.10 | B | 4k | 15k | - | - |
| | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.15±0.15 | J | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | 10k |
| | 1.60±0.50 | P | - | - | 2k | 9k |
| 1210 (3225) | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | 8k |
| | 2.00±0.20 | K | - | - | 1k | 6k |
| | 2.50±0.50 | M | - | - | 1k | 6k |
| 1808 (4520) | 1.25±0.10 | D | - | - | 2k | 10k |
| | 1.60±0.20 | G | | | 2k | 8k |
| | 2.00±0.20 | K | - | - | 1k | 6k |
| 1812 (4532) | 1.25±0.10 | D | - | - | 1k | 5k |
| | 1.60±0.20 | G | - | - | 1k | 4k |
| | 2.00±0.20 | K | - | - | 1k | 3k |
| | 2.50±0.50 | M | - | - | 0.5k | 3k |
| 1825 (4563) | 2.00±0.20 | K | - | - | 1k | - |
| 2220 (5750) | 2.50±0.30 | M | - | - | 0.5k | - |
| 2225 (5763) | 2.80±0.30 | U | - | - | 0.5k | - |

Unit: pieces

## 9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual and Mechanical</td><td>---</td><td>* No remarkable defect.<br>* Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>*Test temp.: Room Temperature.</td><td>* Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>*Class I: (NP0)<br>≦1000pF, 1.0±0.2Vrms，1MHz±10%<br>＞1000pF, 1.0±0.2Vrms，1KHz±10%<br>Class II: (X7R, X7E, X6S, X5R,X7S)<br>C≦10μF, 1.0±0.2Vrms，1KHz±10% **<br>C＞10μF, 0.5±0.2Vrms，120Hz±20%<br><br>** Test condition: 0.5±0.2Vrms，1KHz±10%<br>X7R:<br>0603/475(6.3V)<br>X5R:<br>0201≧224 (6.3V,10V,16V)#1,<br>0402≧475 (6.3V,16V), 0402≧225(10V),<br>0603=106 (6.3V)<br>TT18X≧475(10V) , TT15X series<br>X6S:<br>0201/474(4V),0201>104 (6.3V,10V),<br>0402≧225 (6.3V),<br>0402/475 (10V), 0603/106 (6.3V),<br>X7S:<br>0402/225(6.3V)<br><br>#1 Excluding<br>X5R/0201/105(6.3V);225(10V) ,<br>0402X475M6R3<br>(1.0±0.2Vrms，1KHz±10%)<br><br>*Before initial measurement (Class II only):<br>To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.</td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C<br>X7R,X5R,X6S,X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF;TT series</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;TT series</td></tr>
<tr><td>≦12.5%</td><td>1206/X5R=10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF(0201/X5R>0.01μF);0603≧0.47μF;TT series;<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.47μF;0805/X5R/X6S=10μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0402≧0.033μF;<br>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μ(0201/X5R>0.01μF;0201/X7R≧0.022μF);0402≧0.22uF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF;TT series</td></tr>
<tr><td>≦12.5%</td><td>0402/X5R≧1μF;0402/X6S=1μF;0805/X5R/X6S=10μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.22μF;0603≧0.33μF;TT series;<br>0805≧2.2μF;1206≧2.2μF;1210≧22μF:01R5/X5R</td></tr>
<tr><td>≦12.5%</td><td>0805/X5R/X6S=10μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF;0603/X5R≧10μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Dielectric Strength</td><td>*To apply voltage:<br>≦100V: 250% of rated voltage.<br>200V ~ 300V: 200% of rated voltage.<br>400V ~ 450V: 120% of rated voltage.<br>500V ~ 999V: 150% of rated voltage.<br>1000V ~ 3000V: 120% of rated voltage.<br>4000V: 110% of rated voltage.<br>*Duration: 1 to 5 sec.<br>*Charge & discharge current less than 50mA.</td><td>* No evidence of damage or flash over during test.</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>*Test temp.: Room Temperature.<br><br>*To apply rated voltage for MAX. 120sec.</td><td>10GΩ or RxC≧500Ω-F whichever is smaller.<br>Class II (X7R, X7E, X5R,X6S,X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="6">10GΩ or RxC≧100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0805≥2.2μF;1206≧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: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>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 ; TT series; Size≥1812</td><td rowspan="10">RxC≧50 Ω-F.</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>All X6S items, All X7S items</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;</td></tr>
<tr><td>4V:0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr>
</table></td></tr>
<tr><td></td><td></td><td>Rated voltage: 200~630V — To apply rated voltage (500V max.) for 60 sec.<br>Rated voltage: >630V — To apply 500V for 60 sec.</td><td>≥10GΩ or RxC≥100Ω-F whichever is smaller</td></tr>
<tr><td>6.</td><td>Temperature Coefficient</td><td>With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7S</td><td>-55 ~ 125℃ at 25℃</td></tr>
<tr><td>X5R</td><td>-55~ 85℃ at 25℃</td></tr>
<tr><td>X6S</td><td>-55~105℃ at 25℃</td></tr>
</table>
*Before initial measurement (Class II only):<br>To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>* Measurement voltage for Class II:
<table>
<tr><th>01005</th><th>0201</th></tr>
<tr><td>Cap≤0.01μF: 0.5V</td><td>Cap<0.1μF:1V</td></tr>
<tr><td>Cap>0.01μF: 0.2V</td><td>0.1μF≤Cap<1μF: 0.2V*</td></tr>
<tr><td></td><td>Cap≥1μF: 0.1V*</td></tr>
<tr><td>*0201X104/6.3V~25V: 0.5V<br>0201X224&474/10V: 0.5V</td><td>*0201S104/6.3V~16V: 0.3V<br>0201S224/6.3V: 0.3V<br>0201X105/6.3V&10V: 0.3V</td></tr>
<tr><th>0402</th><th>0603</th></tr>
<tr><td>Cap<1μF: 1V</td><td>Cap<1μF: 1V</td></tr>
<tr><td>Cap=1μF: 0.5V**<br>0402B224-16V: 0.5V<br>0402B474-10V: 0.5V<br>0402X475M6R3: 0.5V</td><td>1μF≤Cap≤4.7μF: 0.5V<br>0603X106-10V: 0.5V</td></tr>
<tr><td>1μF<Cap<10μF: 0.2V<br>**0402B105M6R3V: 0.2V</td><td>Cap>4.7μF: 0.2V</td></tr>
<tr><td>Cap≥10μF: 0.1V</td><td></td></tr>
<tr><th>0805</th><th>1206/1210</th></tr>
<tr><td>Cap<10μF: 1V</td><td>Cap≤10μF: 1V</td></tr>
<tr><td>Cap=10μF: 0.5V<br>0805B475/6.3V~25V: 0.5V</td><td>10μF<Cap≤100μF: 0.5V</td></tr>
<tr><td>Cap>10μF: 0.2V</td><td>Cap>100μF: 0.2V<br>1206X107-6.3V: 0.2V</td></tr>
</table></td><td>
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO</td><td>Within ±30ppm/℃</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X7S</td><td>Within ±22%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>X6S</td><td>Within ±22%</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>7.</td><td>Adhesive Strength of Termination</td><td>* Pressurizing force：<br>2N (0201) and 5N (≤0603) and 10N (>0603)<br>* Test time: 10±1 sec.</td><td>* No remarkable damage or removal of the terminations.</td></tr>
<tr><td>8.</td><td>Vibration Resistance</td><td>* 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>*Before initial measurement (Class II only):<br>To apply de-aging at 150℃ for 1hr then set for 24± 2 hrs at room temp.<br>*Cap./DF(Q) Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.<br>* Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9.</td><td>Solderability</td><td>* Solder temperature: 235±5℃<br>* Dipping time: 2±0.5 sec.</td><td>* 75% min. coverage of all metalized area.</td></tr>
<tr><td>10.</td><td>Bending Test</td><td>* 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>*Before initial measurement (Class II only):<br>To apply de-aging at 150℃ for 1hr then set for 24± 2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change：<br>NP0: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±12.5%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>11.</td><td>Resistance to Soldering Heat</td><td>* Solder temperature: 260±5℃<br>* Dipping time: 10±1 sec<br>* Preheating: 120 to 150℃ for 1 minute before imme rse the capacitor in a eutectic solder.<br>*Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>*Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.<br>* Cap change:<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±7.5%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.<br>* 25% max. leaching on each edge.</td></tr>
<tr><td>12.</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</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>
*Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.<br>* Cap change：<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±7.5%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
</table>

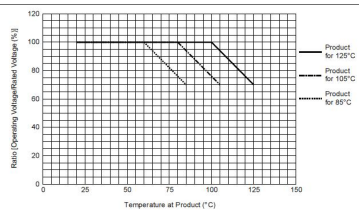
* "Room condition" Temperature: 15 to 35℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>13.</td><td>Humidity (Damp Heat) Steady State</td><td>*Test temp.: 40±2℃<br>*Humidity: 90~95%RH<br>*Test time: 500+24/-0hrs.<br>*Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.<br>* Cap change:<br>NP0: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;<br>TT series & C≥ 1uF,within ±25%<br>**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;<br>* Q/D.F. value:<br>NP0: More than 30pF Q≥350, 10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF Q≥200+10C<br>X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="3">≧ 100V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF;TT series</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF); 0603≧0.47μF;TTseries<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*;</td></tr>
<tr><td>≦20%</td><td>0402≧0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF;TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF;<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;TT series;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>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 ; TT series ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>14</td><td>Humidity (Damp Heat) Load</td><td>*Test temp.：40±2℃<br>*Humidity：90~95%RH<br>*Test time：500+24/-0 hrs.<br>*To apply voltage：<br>Rated voltage (MAX. 500V)<br>*Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.<br>Cap change:<br>NP0: ±7.5% or 0.75pF whichever is larger.<br>X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;<br>TT series & C≥ 1uF,within ±25%<br>**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;<br>Q/D.F. value:<br>NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C<br>X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="3">≧ 100V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF;TT series</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="5">25V</td><td rowspan="5">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF); 0603≧0.47μF;TTseries<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*;</td></tr>
<tr><td>≦20%</td><td>0402≧0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF;TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF;<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;TT series;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">500MΩ or RxC≧5 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>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 ; TT series ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>
* Test temp. :<br>NP0, X7R/X7E/X7S: 125±3℃<br>X6S: 105±3℃<br>X5R: 85±3℃<br>*Test time: 1000+24/-0 hrs.<br>*To apply voltage:<br>(1) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="2">0201</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>≦10V</td><td>C≧0.1μF</td></tr>
<tr><td>≧16V</td><td>C >0.1μF</td></tr>
<tr><td rowspan="3">0402</td><td rowspan="2">X5R</td><td>≦16V</td><td>C >1.0μF</td></tr>
<tr><td>25V,50V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="2">X6S</td><td>6.3V,10V</td><td>C >1.0μF</td></tr>
<tr><td>16V,25V</td><td>C≧1.0μF</td></tr>
<tr><td>X7R/X7S/Y5V</td><td>6.3V,10V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="3">0603</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>4V</td><td>C≧22μF</td></tr>
<tr><td>6.3V,10V</td><td>C≧4.7μF#1</td></tr>
<tr><td>X5R/X6S/X7S</td><td>25V</td><td>C≧1.0μF</td></tr>
<tr><td>X7R</td><td>35V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="5">0805</td><td rowspan="3">X5R/X7R/ X6S/X7S</td><td>4V</td><td>C≧47μF</td></tr>
<tr><td>6.3V</td><td>C≧22μF</td></tr>
<tr><td>10V,50V</td><td>C≧10μF</td></tr>
<tr><td rowspan="2">X6S</td><td>16V</td><td>C >10μF</td></tr>
<tr><td>25V</td><td>C≧10μF</td></tr>
<tr><td>X7R/X7S</td><td rowspan="2">16V,25V</td><td>C≧10μF</td></tr>
<tr><td>X5R</td><td>C≧22μF</td></tr>
<tr><td>1206</td><td>X5R/X7R/X6S</td><td>≦6.3V</td><td>C≧47μF</td></tr>
<tr><td rowspan="2">1210</td><td>X5R/X7R/X6S</td><td>16V</td><td>C≧47μF</td></tr>
<tr><td>X7R</td><td>100V</td><td>C≧3.3μF</td></tr>
</table>
**1WV items must follow de-rating conditions.<br>#1. 0603X106(10V)&0603S106(4V&6.3V):150% of rated voltage<br>(2) 150% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="2">0201</td><td>X5R/X6S</td><td>16V,25V</td><td>C=0.1μF</td></tr>
<tr><td>X7R</td><td>16V</td><td>C≧0.022μF</td></tr>
<tr><td rowspan="2">0402</td><td rowspan="2">X7R/X5R/ X6S</td><td>50V</td><td>C>0.01μF</td></tr>
<tr><td>10~25V</td><td>C≧0.22μF</td></tr>
<tr><td rowspan="5">0603</td><td>X7S</td><td>50V~100V</td><td>C>0.22μF</td></tr>
<tr><td rowspan="2">X7R</td><td>50V</td><td>C>0.1μF</td></tr>
<tr><td>25V</td><td>C=1.0μF</td></tr>
<tr><td>X5R</td><td>50V</td><td>C≧1.0μF</td></tr>
<tr><td>X5R/X7R/ X6S/X7S</td><td>10V,16V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="4">0805</td><td rowspan="4">X5R/X7R/ X6S/X7S</td><td>100V</td><td>C≧0.47μF</td></tr>
<tr><td>50V</td><td>C≧0.68μF</td></tr>
<tr><td>35V</td><td>C≧2.2μF</td></tr>
<tr><td>10~25V</td><td>C≧4.7μF</td></tr>
<tr><td rowspan="3">1206</td><td rowspan="2">X7R</td><td>100V</td><td>C≧1.0μF</td></tr>
<tr><td>50V</td><td>C≧2.2μF</td></tr>
<tr><td>X5R/X6S/ X7S</td><td>100V</td><td>C>1.0μF</td></tr>
<tr><td>1210</td><td>X5R/X7R/ X6S/X7S</td><td>50V~100V</td><td>C≧2.2μF</td></tr>
<tr><td>1825<br>2220<br>2225</td><td>X7R</td><td>100V~250V</td><td>C≧1.0μF</td></tr>
</table>
(3)≦6.3V or C≧10μF: 150% of rated voltage.<br>(4) 10V~250V: 200% of rated voltage.<br>(5) 400V~450V: 120% of rated voltage.<br>(6) 500V: 150% of rated voltage.<br>(7) 630V~3000V:120% of rated voltage, Excluding 1210/X7R/103/2KV(110% of rated voltage)<br>(8) 4000V: 110% of rated voltage<br>* Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.<br>** De-rating conditions:<br>


</td><td>
* No remarkable damage.<br>Cap change:<br>NP0: ±3.0% or ±0.3pF whichever is larger<br>X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;<br>TT series & C≥ 1uF,within ±25%<br>**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;<br>Q/D.F. value:<br>NP0: More than 30pF, Q≥350<br>10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF, Q≥200+10C<br>X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="3">≧ 100V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF;TT series</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="5">25V</td><td rowspan="5">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF); 0603≧0.47μF;TTseries<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*;</td></tr>
<tr><td>≦20%</td><td>0402≧0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF;TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF;<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;TT series;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="6">1GΩ or RxC≧ 10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;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; 1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td><td></td></tr>
</table>
</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

# APPENDIXES

## ◙ Tape & reel dimensions

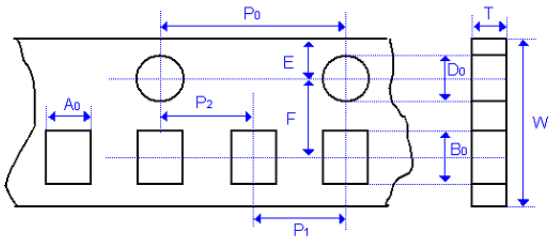



Fig. 2 The dimension of paper tape

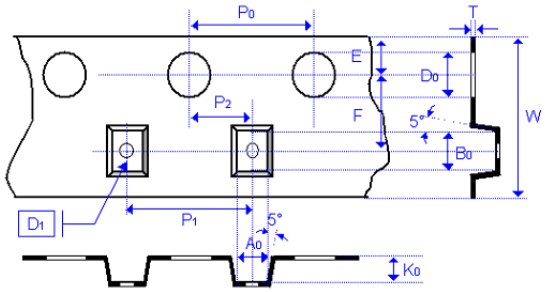



Fig. 3 The dimension of plastic tape

| Size | 0402 | 0603 | 0805 | | | 1206 | | | 1210 | | 1808 | 1812 | | 1825 | | 2220 | | 2225 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thickness | N,E | S,X | A,H | B,T | D,I | B,T | C,J, D | G,P | C,D, G,K | M | D,F, G,K | D,F, G,K | M,U | K | M,U | K | M,U | K | M,U |
| $A_0$ | 0.70 +/-0.20 | 1.05 +/-0.30 | 1.50 +/-0.20 | 1.50 +/-0.20 | < 1.80 | 1.90 +/-0.50 | < 2.00 | <2.30 | < 3.05 | < 3.20 | < 2.50 | < 3.90 | < 3.90 | < 6.80 | < 6.80 | < 5.80 | < 5.80 | < 6.80 | < 6.80 |
| $B_0$ | 1.20 +/-0.20 | 1.80 +/-0.30 | 2.30 +/-0.20 | 2.30 +/-0.20 | < 2.70 | 3.50 +/-0.50 | < 3.70 | < 4.00 | < 3.80 | <4.00 | < 5.30 | < 5.30 | < 5.30 | < 5.30 | < 5.30 | < 6.50 | < 6.50 | < 6.50 | < 6.50 |
| T | ≦0.80 | ≦1.20 | ≦1.15 | ≦1.20 | 0.23 +/-0.1 | ≦1.20 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.30 +/-0.1 | 0.30 +/-0.1 | 0.30 +/-0.1 | 0.30 +/-0.1 | 0.30 +/-0.1 | 0.30 +/-0.1 |
| $K_0$ | - | - | - | - | < 2.50 | - | < 2.50 | < 2.50 | < 2.50 | < 3.20 | < 2.50 | < 2.50 | < 3.50 | < 2.50 | < 3.50 | < 2.50 | < 3.50 | < 2.50 | < 3.50 |
| W | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 |
| $P_0$ | 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 | 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 | 4.00 +/-0.10 |
| $10xP_0$ | 40.00 +/-0.10 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.0 +/-0.20 | 40.0 +/-0.20 | 40.0 +/-0.20 | 40.0 +/-0.20 |
| $P_1$ | 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 | 4.00 +/-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 |
| $P_2$ | 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 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 |
| $D_0$ | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 |
| $D_1$ | - | - | - | - | 1.00 +/-0.10 | - | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 |
| E | 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 | 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 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 |
| F | 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 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.05 | 5.50 +/-0.05 | 5.50 +/-0.05 | 5.50 +/-0.05 | 5.50 +/-0.05 | 5.50 +/-0.05 |

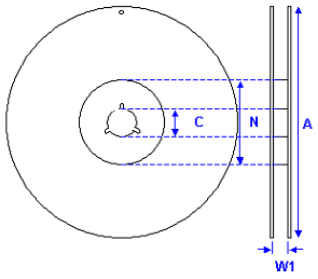
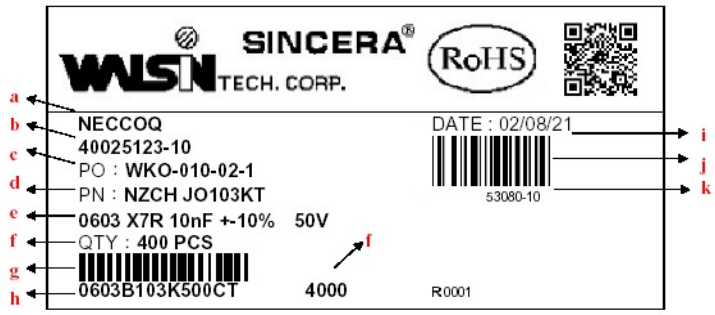



Fig. 4 The dimension of reel

| Size | 0402, 0603, 0805, 1206, 1210 | | | 1808 to 2225 |
|---|---|---|---|---|
| Reel size | 7" | 10" | 13" | 7" |
| C | 13.0±0.5 | 13.0±0.5 | 13.0±0.5 | 13.0±0.5 |
| $W_1$ | 10.0±1.5 | 10.0±1.5 | 10.0±1.5 | 12.4+2.0/-0 |
| A | 178.0±2.0 | 250.0±2.0 | 330.0±2.0 | 178.0±2.0 |
| N | 60.0+1.0/-0 | 50 min | 50 min | 60.0+1.0/-0 |

## Example of customer label




*Customized label is available upon request

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 | | X7R |
|---|---|---|---|
| ① | Ceramic material | | $BaTiO_3$ based |
| ② | Inner electrode | | Ni |
| ③ | Termination | Inner layer | Cu + Cu Polymer |
| ④ | | Middle layer | Ni |
| ⑤ | | Outer layer | Sn |

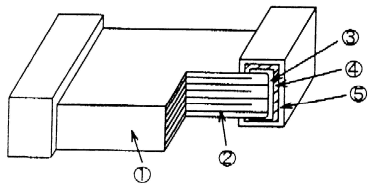



Fig. 5 The construction of MLCC

## Storage and handling conditions

(1) To store products at 5 to 40°C ambient temperature and 20 to 70%. related humidity conditions; MSL Level 1.

(2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

a. 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.)

b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.

c. 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 $N_2$ within oven are recommended.

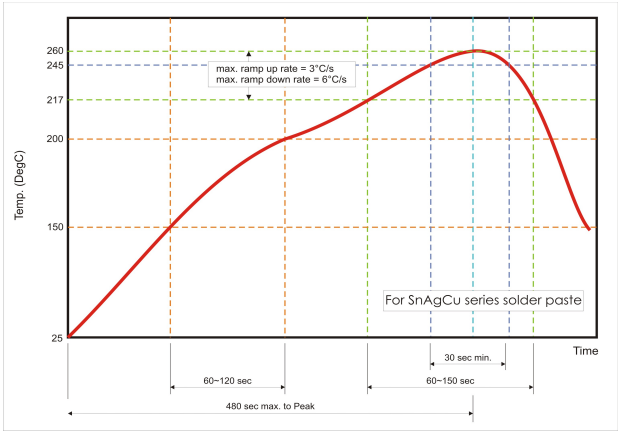



Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

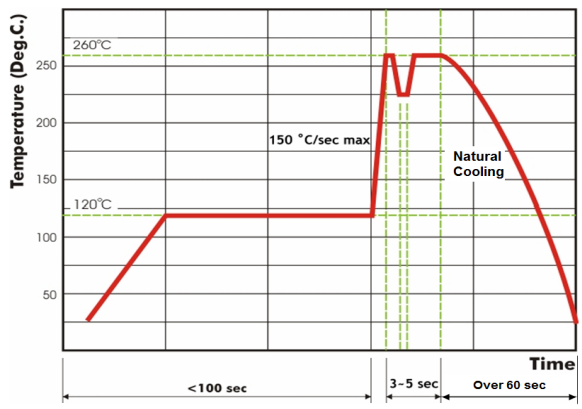



Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.