# APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Middle & High Voltage Series (200V to 4kV)

0402 to 1812 Sizes

NP0, X7R & Y5V Dielectrics

Halogen Free & RoHS compliance

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# 1. INTRODUCTION

WTC middle and high voltage series MLCC is designed by a special internal electrode pattern, which can reduce voltage concentrations by distributing voltage gradients throughout the entire capacitor. This special design also affords increased capacitance values in a given case size and voltage rating.

Chips size 1206 and larger to use on reflow soldering process only. Capacitors with X7R dielectrics are not intended for AC line filtering applications. Capacitors may require protective surface coating to prevent external arcing.

# 2. FEATURES

a. High voltage in a given case size.
b. High stability and reliability.

# 3. APPLICATIONS

a. Snubbers in high frequency power converters.
b. High voltage coupling/DC blocking.
c. DC-DC converters.
d. Back-lighting inverters

# 4. HOW TO ORDER

| 1808 | N | 100 | J | 202 | C | T |
|---|---|---|---|---|---|---|
| **Size** | **Dielectric** | **Capacitance** | **Tolerance** | **Rated voltage** | **Termination** | **Packaging** |
| Inch (mm)<br>**0402** (1005)<br>**0603** (1608)<br>**0805** (2012)<br>**1206** (3216)<br>**1210** (3225)<br>**1808** (4520)<br>**1812** (4532) | **N**=NP0 (C0G)<br>**B**=X7R<br>**F**=Y5V | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>100=10x10$^0$ =10pF | **B**=±0.1pF<br>**C**=±0.25pF<br>**D**=±0.5pF<br>**F**=±1%<br>**G**=±2%<br>**J**=±5%<br>**K**=±10%<br>**M**=±20%<br>**Z**=-20/+80% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><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<br>**252**=2500 VDC<br>**302**=3000 VDC<br>**402**=4000 VDC | **C**=Cu/Ni/Sn | **T**=7" reeled<br>**G**=13" reeled |


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## 5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm) | W (mm) | T (mm)/Symbol | | Remark | $M_B$ (mm) |
|---|---|---|---|---|---|---|
| 0402 (1005) | 1.00±0.05 | 0.50±0.05 | 0.50±0.05 | N | # | 0.25 +0.05/-0.10 |
| 0603(1608) | 1.60±0.10 | 0.80±0.10 | 0.80±0.07 | S | | 0.40±0.15 |
| | 1.60 +0.15/-0.10 | 0.80 +0.15/-0.10 | 0.80 +0.15/-0.10 | X | | |
| 0805 (2012) | 2.00±0.15 | 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±0.20 | 1.25±0.20 | 1.25±0.20 | I | # | |
| 1206 (3216) | 3.20±0.15 | 1.60±0.15 | 0.80±0.10 | B | | 0.60±0.20 (0.5±0.25)* |
| | | | 0.95±0.10 | C | # | |
| | | | 1.25±0.10 | D | # | |
| | 3.20±0.20 | 1.60±0.20 | 1.60±0.20 | G | # | |
| 1210 (3225) | 3.20±0.30 | 2.50±0.20 | 0.95±0.10 | C | # | 0.75±0.25 |
| | | | 1.25±0.10 | D | # | |
| | 3.20±0.40 | 2.50±0.30 | 1.60±0.20 | G | # | |
| | | | 2.00±0.20 | K | # | |
| | | | 2.50±0.30 | M | # | |
| | 3.20±0.60** | 2.50±0.50** | 2.50±0.50** | | | |
| 1808 (4520) | 4.50+0.5/-0.3 | 2.03±0.25 | 1.25±0.10 | D | # | 0.50±0.25 |
| | | | 2.00±0.20 | K | # | |
| 1812 (4532) | 4.50+0.5/-0.3 | 3.20±0.30 | 1.25±0.10 | D | # | 0.50±0.25 |
| | | | 1.60±0.20 | G | # | |
| | | | 2.00±0.20 | K | # | |
| | | 3.20±0.40 | 2.50±0.30 | M | # | |
| | | | 2.80±0.30 | U | # | |

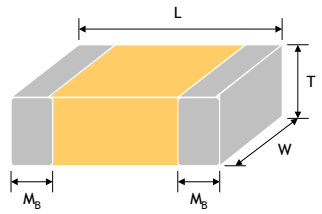

Fig. 1 The outline of MLCC

# Reflow soldering only is recommended.
* For 1206_1000V ~3000V products.
** For 1210_100V: Cap > 1μF, 250V: Cap >0. 47μF, 400V~630V: Cap >0.22μF.

## 6. GENERAL ELECTRICAL DATA

| Dielectric | NP0 | X7R | Y5V |
|---|---|---|---|
| Size | 0402, 0603, 0805, 1206, 1210, 1808, 1812 | | 0805, 1206, 1210, 1812 |
| Capacitance* | 0.5pF to 0.033μF | 100pF to 1.0μF | 0.01μF to 0.68μF |
| Capacitance tolerance*** | Cap≤5pF: C (±0.25pF)<br>5pF<Cap<10pF: D (±0.5pF)<br>Cap≥10pF: F (±1%), G (±2%),<br>J (±5%),K (±10%) | K (±10%), M (±20%) | Z (-20/+80%) |
| Rated voltage (WVDC) | 200V to 4000V | | 200V, 250V |
| Q/DF* | Cap<30pF: Q≥400+20C<br>Cap≥30pF: Q≥1000 | DF≤2.5% | DF≤5% |
| Insulation resistance at Ur** | Ur=200~630V: ≥10GΩ or RxC≥100Ω-F whichever is smaller<br>Ur=1000~3000V: ≥10GΩ | | |
| Dielectric strength | 200~300V: ≥2 x WVDC<br>400V~450V: ≥1.2 x WVDC<br>500~999V: ≥1.5 x WVDC<br>1000~3000V: ≥1.2 x WVDC<br>4000: ≥1.1 x WVDC | | |
| Operating temperature | -55 to +125℃ | | -25 to +85℃ |
| Capacitance characteristic | ±30ppm | ±15% | +30/-80% |
| 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.
Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20℃ ambient 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.


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# 7. CAPACITANCE RANGE (MIDDLE VOLTAGE - 200V to 630V)

## 7-1 NP0 Dielectric

| DIELECTRIC | | NP0 | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0402 | | 0603 | | 0805 | | | | 1206 | | | | 1210 | | | | 1808 | | 1812 | | | |
| RATED VOLTAGE (VDC) | | 200 | 250 | 200 | 250 | 200 | 250 | 500 | 630 | 200 | 250 | 500 | 630 | 200 | 250 | 500 | 630 | 500 | 630 | 200 | 250 | 500 | 630 |
| Capacitance | 0.5pF (0R5) | N | N | S | S | A | A | A | A | | | | | | | | | | | | | | |
| | 1.0pF (1R0) | N | N | S | S | A | A | A | A | | | | | | | | | | | | | | |
| | 1.2pF (1R2) | N | N | S | S | A | A | A | A | | | | | | | | | | | | | | |
| | 1.5pF (1R5) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | | | | | | |
| | 1.8pF (1R8) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 2.2pF (2R2) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 2.7pF (2R7) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 3.3pF (3R3) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 3.9pF (3R9) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 4.7pF (4R7) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 5.6pF (5R6) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 6.8pF (6R8) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 8.2pF (8R2) | N | N | S | S | A | A | A | A | B | B | B | B | | | | | D | D | | | | |
| | 10pF (100) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 12pF (120) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 15pF (150) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 18pF (180) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 22pF (220) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 27pF (270) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 33pF (330) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 39pF (390) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 47pF (470) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 56pF (560) | N | N | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 68pF (680) | N | | S | S | A | A | A | A | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 82pF (820) | N | | S | S | A | A | B | B | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 100pF (101) | N | | S | S | A | B | B | B | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 120pF (121) | | | S | S | A | B | D | D | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 150pF (151) | | | S | S | B | D | D | D | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 180pF (181) | | | S | S | B | D | D | D | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 220pF (221) | | | S | S | D | D | D | D | B | B | B | B | C | C | C | C | D | D | D | D | D | D |
| | 270pF (271) | | | X | X | D | D | D | D | B | C | C | C | C | C | C | C | K | K | D | D | D | D |
| | 330pF (331) | | | X | X | D | D | D | D | B | C | C | C | C | C | C | C | K | K | D | D | D | D |
| | 390pF (391) | | | X | X | D | D | D | D | B | C | C | C | C | C | C | C | K | K | D | D | D | D |
| | 470pF (471) | | | X | X | D | D | I | I | C | C | C | C | C | C | C | C | K | K | D | D | D | D |
| | 560pF (561) | | | X | X | D | D | I | I | C | D | D | D | C | C | C | C | K | K | D | D | D | D |
| | 680pF (681) | | | | | D | D | I | I | C | D | D | D | C | C | C | C | K | K | D | D | D | D |
| | 820pF (821) | | | | | D | D | I | I | C | G | G | G | C | C | C | C | K | K | D | D | D | D |
| | 1,000pF (102) | | | | | D | D | I | I | C | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 1,200pF (122) | | | | | D | D | | | C | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 1,500pF (152) | | | | | D | D | | | D | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 1,800pF (182) | | | | | D | D | | | D | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 2,200pF (222) | | | | | D | D | | | D | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 2,700pF (272) | | | | | | | | | D | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 3,300pF (332) | | | | | | | | | D | G | G | G | D | D | D | D | K | K | D | D | D | D |
| | 3,900pF (392) | | | | | | | | | D | G | G | G | D | D | D | D | | | D | D | D | D |
| | 4,700pF (472) | | | | | | | | | D | G | G | G | G | G | | | | | D | D | D | D |
| | 5,600pF (562) | | | | | | | | | | | | | G | G | | | | | D | D | D | D |
| | 6,800pF (682) | | | | | | | | | | | | | G | G | | | | | D | D | D | D |
| | 8,200pF (822) | | | | | | | | | | | | | G | G | | | | | | | D | D |
| | 0.010μF (103) | | | | | | | | | | | | | G | G | | | | | | | D | D |
| | 0.015μF (153) | | | | | | | | | | | | | M | | | | | | | | G | G |
| | 0.022μF (223) | | | | | | | | | | | | | M | | | | | | | | K | K |
| | 0.033μF (333) | | | | | | | | | | | | | | | | | | | | | | |

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



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## 7-2 X7R Dielectric

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0603 | | 0805 | | | | 1206 | | | | | | 1210 | | | | | | 1808 | | 1812 | | | |
| RATED VOLTAGE (VDC) | | 200 | 250 | 200 | 250 | 500 | 630 | 200 | 250 | 400 | 450 | 500 | 630 | 200 | 250 | 400 | 450 | 500 | 630 | 500 | 630 | 200 | 250 | 500 | 630 |
| Capacitance | 100pF (101) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | | | | | | |
| | 120pF (121) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | | | | | | |
| | 150pF (151) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 180pF (181) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 220pF (221) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 270pF (271) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 330pF (331) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 390pF (391) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 470pF (471) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 560pF (561) | X | X | B | B | B | B | D | D | | | D | D | D | D | | | D | D | D | D | | | | |
| | 680pF (681) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | | | | |
| | 820pF (821) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | | | | |
| | 1,000pF (102) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 1,200pF (122) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 1,500pF (152) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 1,800pF (182) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 2,200pF (222) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 2,700pF (272) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 3,300pF (332) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 3,900pF (392) | X | X | B | B | B | B | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 4,700pF (472) | X | X | B | B | D | D | D | D | | | D | D | C | C | | | D | D | D | D | D | D | D | D |
| | 5,600pF (562) | X | X | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 6,800pF (682) | X | X | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 8,200pF (822) | X | X | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 0.010μF (103) | X | X | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 0.012μF (123) | | | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 0.015μF (153) | | | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 0.018μF (183) | | | D | D | D | D | D | D | | | D | D | C | C | | | D | D | K | K | D | D | D | D |
| | 0.022μF (223) | | | D | D | D | D | D | D | | | G | G | C | C | | | D | D | K | K | D | D | D | D |
| | 0.027μF (273) | | | D | D | D | D | D | D | | | G | G | C | C | | | G | G | K | K | D | D | D | D |
| | 0.033μF (333) | | | D | D | D | | G | G | | | G | G | C | C | | | G | G | K | K | D | D | D | D |
| | 0.039μF (393) | | | D | D | | | G | G | | | G | G | C | C | | | G | G | K | K | D | D | D | D |
| | 0.047μF (473) | | | D | D | | | G | G | | | G | G | D | D | | | G | G | K | K | D | D | D | D |
| | 0.056μF (563) | | | D | D | | | G | G | | | G | G | D | D | | | G | G | K | K | D | D | K | K |
| | 0.068μF (683) | | | D | D | | | G | G | G | G | | | G | G | | | K | K | K | K | D | D | K | K |
| | 0.082μF (823) | | | D | | | | G | G | G | G | | | G | G | | | K | K | K | K | D | D | K | K |
| | 0.10μF (104) | | | D | | | | G | G | G | G | | | G | G | | | K | K | | | D | D | K | K |
| | 0.12μF (124) | | | | | | | G | G | | | | | G | G | M | M | | | | | D | D | M | M |
| | 0.15μF (154) | | | | | | | G | G | | | | | M | M | M | M | | | | | K | K | M | M |
| | 0.18μF (184) | | | | | | | G | G | | | | | M | M | M | M | | | | | K | K | M | M |
| | 0.22μF (224) | | | | | | | G | G | | | | | M | M | M | M | | | | | K | K | M | M |
| | 0.27μF (274) | | | | | | | | | | | | | M | M | M | M | | | | | K | K | M | |
| | 0.33μF (334) | | | | | | | | | | | | | M | M | M | M | | | | | K | K | M | |
| | 0.39μF (394) | | | | | | | | | | | | | M | M | | | | | | | K | K | M | |
| | 0.47μF (474) | | | | | | | | | | | | | M | M | | | | | | | K | K | M | |
| | 0.56μF (564) | | | | | | | | | | | | | M | M | | | | | | | M | M | | |
| | 0.68μF (684) | | | | | | | | | | | | | M | M | | | | | | | M | M | | |
| | 0.82μF (824) | | | | | | | | | | | | | | | | | | | | | M | M | | |
| | 1.0μF (105) | | | | | | | | | | | | | | | | | | | | | M | M | | |

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



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## 7-3 Y5V Dielectric

| DIELECTRIC | | Y5V | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0805 | | 1206 | | 1210 | | 1812 | |
| RATED VOLTAGE (VDC) | | 200 | 250 | 200 | 250 | 200 | 250 | 200 | 250 |
| Capacitance | 0.010μF (103) | B | B | B | B | C | C | D | D |
| | 0.015μF (153) | B | B | B | B | C | C | D | D |
| | 0.022μF (223) | B | B | B | B | C | C | D | D |
| | 0.033μF (333) | B | B | B | B | C | C | D | D |
| | 0.047μF (473) | B | B | B | B | C | C | D | D |
| | 0.068μF (683) | B | B | B | B | C | C | D | D |
| | 0.10μF (104) | | | B | B | C | C | D | D |
| | 0.15μF (154) | | | C | C | C | C | D | D |
| | 0.22μF (224) | | | | | | | D | D |
| | 0.33μF (334) | | | | | | | D | D |
| | 0.47μF (474) | | | | | | | D | D |
| | 0.68μF (684) | | | | | | | D | D |
| | 1.0μF (105) | | | | | | | | |

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

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# 8. CAPACITANCE RANGE (HIGH VOLTAGE - 1kV to 4kV)

## 8-1 NP0 Dielectric

| DIELECTRIC | | NP0 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0805 | 1206 | | | 1210 | | | 1808 | | | | | 1812 | | | | |
| RATED VOLTAGE | | 1000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 3000 | 4000 | 1000 | 1500 | 2000 | 3000 | 4000 |
| Capacitance | 0.5pF (0R5) | D | | | | | | | | | | | | | | | | |
| | 1.0pF (1R0) | D | | | | | | | | | | | | | | | | |
| | 1.2pF (1R2) | D | | | | | | | | | | | | | | | | |
| | 1.5pF (1R5) | D | B | B | B | | | | | | | | | | | | | |
| | 1.8pF (1R8) | D | B | B | B | | | | | | | | | | | | | |
| | 2.0pF (2R0) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 2.2pF (2R2) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 2.7pF (2R7) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 3.3pF (3R3) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 3.9pF (3R9) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 4.7pF (4R7) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 5.6pF (5R6) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 6.8pF (6R8) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 8.2pF (8R2) | D | B | B | B | | | | D | D | D | D | | | | | | |
| | 10pF (100) | D | B | B | B | C | C | C | D | D | D | D | | D | D | D | D | |
| | 12pF (120) | D | B | B | B | C | C | C | D | D | D | D | | D | D | D | D | |
| | 15pF (150) | D | B | B | B | C | C | C | D | D | D | D | | D | D | D | D | |
| | 18pF (180) | D | B | B | B | C | C | C | D | D | D | D | | D | D | D | D | |
| | 22pF (220) | D | B | B | B | C | C | C | D | D | D | D | | D | D | D | D | |
| | 27pF (270) | D | B | B | B | C | C | C | D | D | D | D | | D | D | D | D | |
| | 33pF (330) | D | B | C | C | C | C | C | D | D | D | D | | D | D | D | D | |
| | 39pF (390) | D | B | C | C | C | C | C | D | D | D | D | | D | D | D | D | |
| | 47pF (470) | D | C | C | C | C | C | C | D | D | D | D | | D | D | D | D | |
| | 56pF (560) | D | C | D | D | C | D | D | D | D | D | D | | D | D | D | D | |
| | 68pF (680) | D | C | D | D | C | D | D | D | D | D | D | | D | D | D | D | |
| | 82pF (820) | D | D | D | D | C | D | D | D | D | D | D | | D | D | D | D | |
| | 100pF (101) | D | D | D | D | D | D | D | D | D | K | K | | D | D | D | D | |
| | 120pF (121) | D | D | G | G | D | D | D | D | D | K | K | | D | D | D | D | |
| | 150pF (151) | D | D | G | G | D | G | G | D | K | K | K | | D | D | D | D | |
| | 180pF (181) | D | G | G | G | D | G | G | D | K | K | K | | D | D | K | K | |
| | 220pF (221) | D | G | G | G | G | G | G | D | K | K | K | | D | D | K | K | |
| | 270pF (271) | D | G | P | P | G | K | K | G | K | K | K | | D | K | K | K | |
| | 330pF (331) | D | G | P | P | G | K | K | G | K | K | K | | D | K | K | K | |
| | 390pF (391) | D | G | P | P | G | M | M | K | K | K | | | D | K | K | K | |
| | 470pF (471) | | G | | | G | M | M | K | K | K | | | K | K | K | K | |
| | 560pF (561) | | G | | | G | | | K | K | K | | | K | K | K | | |
| | 680pF (681) | | G | | | G | | | K | K | K | | | K | K | K | | |
| | 820pF (821) | | G | | | G | | | K | D | D | | | K | K | K | | |
| | 1,000pF (102) | | G | | | G | | | K | G | G | | | K | K | K | | |
| | 1,200pF (122) | | | | | G | | | G | | | | | K | | | | |
| | 1,500pF (152) | | | | | K | | | G | | | | | K | | | | |
| | 1,800pF (182) | | | | | M | | | K | | | | | K | | | | |
| | 2,200pF (222) | | | | | M | | | K | | | | | K | | | | |
| | 2,700pF (272) | | | | | M | | | | | | | | K | | | | |
| | 3,300pF (332) | | | | | M | | | | | | | | K | | | | |
| | 3,900pF (392) | | | | | M | | | | | | | | M | | | | |

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



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## 8-2 X7R Dielectric

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0805 | 1206 | | | | 1210 | | | 1808 | | | | | 1812 | | | | |
| RATED VOLTAGE | | 1000 | 1000 | 1500 | 2000 | 2500 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 3000 | 4000 | 1000 | 1500 | 2000 | 3000 | 4000 |
| Capacitance | 100pF (101) | B | D | D | D | D | D | D | D | | | | | | | | | | |
| | 120pF (121) | B | D | D | D | D | D | D | D | | | | | | | | | | |
| | 150pF (151) | B | D | D | D | D | D | D | D | D | D | D | D | K | | | | | |
| | 180pF (181) | B | D | D | D | D | D | D | D | D | D | D | D | K | | | | | |
| | 220pF (221) | B | D | D | D | D | D | D | D | D | D | D | D | K | | | | | |
| | 270pF (271) | B | D | D | D | D | D | D | D | D | D | D | D | K | D | D | D | K | K |
| | 330pF (331) | B | D | D | D | D | D | D | D | D | D | D | K | K | D | D | D | K | K |
| | 390pF (391) | B | D | D | D | D | D | D | D | D | D | D | K | K | D | D | D | K | K |
| | 470pF (471) | B | D | D | D | D | D | D | D | D | D | D | K | K | D | D | D | K | K |
| | 560pF (561) | B | D | D | D | D | D | D | D | D | D | D | K | K | D | D | D | K | K |
| | 680pF (681) | B | D | D | D | D | D | D | D | D | D | D | K | K | D | D | D | K | K |
| | 820pF (821) | B | D | D | D | D | D | D | D | D | D | D | K | K | D | D | D | K | K |
| | 1,000pF (102) | B | D | D | B/C /D/G | D | D | D | D | D | K | K | K | K | D | D | D | K | K |
| | 1,200pF (122) | B | D | G | G | G | D | M | M | D | K | K | K | | D | D | D | K | M |
| | 1,500pF (152) | D | D | G | G | G | D | M | M | D | K | K | K | | D | D | D | K | M |
| | 1,800pF (182) | D | D | G | G | G | D | M | M | D | K | K | K | | D | D | D | M | M |
| | 2,200pF (222) | D | D | G | G | G | D | M | M | D | K | K | | | D | D | D | M | |
| | 2,700pF (272) | D | D | G | G | | D | M | M | D | K | K | | | D | D | D | M | |
| | 3,300pF (332) | D | D | G | G | | D | M | M | D | K | K | | | D | K | K | M | |
| | 3,900pF (392) | D | D | G | | | G | M | M | D | K | K | | | D | K | K | M | |
| | 4,700pF (472) | D | D | G | | | G | M | M | D | K | K | | | D | K | K | M | |
| | 5,600pF (562) | D | D | G | | | G | M | M | K | K | K | | | D | M | M | M | |
| | 6,800pF (682) | D | D | G | | | G | M | M | K | K | K | | | D | M | M | M | |
| | 8,200pF (822) | D | D | G | | | G | M | M | K | K | K | | | D | M | M | | |
| | 0.010μF (103) | D | D | G | | | G | M | | K | K | K | | | D | M | M | | |
| | 0.012μF (123) | | G | | | | G | | | K | | | | | K | M | M | | |
| | 0.015μF (153) | | G | | | | G | | | K | | | | | K | M | M | | |
| | 0.018μF (183) | | | | | | G | | | K | | | | | M | M | M | | |
| | 0.022μF (223) | | | | | | G | | | K | | | | | M | M | M | | |
| | 0.033μF (333) | | | | | | G | | | K | | | | | M | | | | |
| | 0.039μF (393) | | | | | | K | | | K | | | | | M | | | | |
| | 0.047μF (473) | | | | | | M | | | K | | | | | M | | | | |
| | 0.056μF (563) | | | | | | | | | K | | | | | M | | | | |
| | 0.068μF (683) | | | | | | | | | | | | | | M | | | | |
| | 0.10μF (104) | | | | | | | | | | | | | | M | | | | |

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

## 9. PACKAGING DIMENSION AND QUANTITY

| Size | Thickness/Symbol (mm) | | Paper tape | | Plastic tape | |
|---|---|---|---|---|---|---|
| | | | 7" reel | 13" reel | 7" reel | 13" reel |
| 0402 | 0.50±0.05 | N | 10k | 50k | - | - |
| 0603 | 0.80±0.07 | S | 4k | 15k | - | - |
| | 0.80 +0.15/-0.10 | X | 4k | 15k | | |
| 0805 | 0.60±0.10 | A | 4k | 15k | - | - |
| | 0.80±0.10 | B | 4k | 15k | - | - |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.25±0.20 | I | - | - | 3k | 10k |
| 1206 | 0.80±0.10 | B | 4k | 15k | - | - |
| | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | 10k |
| 1210 | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | - |
| | 2.00±0.20 | K | - | - | 1k | 6k |
| | 2.50±0.30 | M | - | - | 1k | 6k |
| 1808 | 1.25±0.10 | D | - | - | 2k | 10k |
| | 2.00±0.20 | K | - | - | 1k | 6k |
| 1812 | 1.25±0.10 | D | - | - | 1k | 5k |
| | 1.60±0.20 | G | - | - | 1k | - |
| | 2.00±0.20 | K | - | - | 1k | - |
| | 2.50±0.30 | M | - | - | 0.5k | 3k |


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Unit: pieces

## 10. 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>Class I: (NP0)</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>Cap≤1000pF, 1.0±0.2Vrms, 1MHz±10%<br>Cap>1000pF, 1.0±0.2Vrms, 1KHz±10%<br>Class II: (X7R, Y5V)<br>1.0±0.2Vrms, 1kHz±10%<br>*Before initial measurement (Class II only): 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: ≤2.5%<br>Y5V: ≤5.0%</td></tr>
<tr><td>4.</td><td>Dielectric Strength</td><td>* To apply voltage:<br>200V~300V ≥2 times VDC<br>400V~450V ≥1.2 times VDC<br>500V~999V ≥1.5 times VDC<br>1000V~3000V ≥1.2 times VDC<br>4000V ≥1.1 times VDC<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>
<tr><td>5.</td><td>Insulation Resistance</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>NP0</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>Y5V</td><td>-25~85℃ at 20℃</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 .</td><td><table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NP0</td><td>Within ±30ppm/℃</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>7.</td><td>Adhesive Strength of Termination</td><td>* Pressurizing force：<br>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): 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>95% 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 1 mm and then the pressure shall be maintained for 5±1 sec.<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>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change：<br>NP0: within ±5.0% or ±0.5pF whichever is larger.<br>X7R: 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.)</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: 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.</td></tr>
</table>



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<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>12.</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.<br><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: within ±7.5%<br>Y5V: within ±20%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></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: NP0: within ±5.0% or ±0.5pF whichever is larger.<br>X7R: within ±12.5%<br>Y5V: within ±30%<br>* Q/D.F. value:<br>NP0: Cap≥30pF, Q≥350; 10pF≤Cap<30pF, Q≥275+2.5C<br>Cap<10pF; Q≥200+10C<br>X7R: ≤3.0%<br>Y5V: ≤7.5%<br>* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</td></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：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: NP0: within ±7.5% or ±0.75pF whichever is larger.<br>X7R: within ±12.5%<br>Y5V: within ±30%<br>* Q/D.F. value:<br>NP0: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C<br>X7R: ≤3.0%<br>Y5V: ≤7.5%<br>* I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.</td></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>* Test temp.:<br>NP0, X7R: 125±3℃<br>Y5V: 85±3℃<br>* To apply voltage:<br>(1) 1206/NP0 (3kV) ≥1.5pF: 100% of rated voltage.<br>(2) 200V~300V: 200% of rated voltage.<br>(3) 400V~450V: 120% of rated voltage.<br>(4) 500V: 150% of rated voltage.<br>(5) 630V~3000V: 120% of rated voltage.<br>(6) 4000V: 110% of rated voltage.<br>* Test time: 1000+24/-0 hrs.<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: NP0: within ±3.0% or ±0.3pF whichever is larger.<br>X7R: within ±12.5%<br>Y5V: within ±30%<br>* Q/D.F. value:<br>NP0: Cap≥30pF, Q≥350<br>10pF≤Cap<30pF, Q≥275+2.5C<br>Cap<10pF, Q≥200+10C<br>X7R: ≤3.0%<br>Y5V: ≤7.5%<br>* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</td></tr>
</table>


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# APPENDIXES

## ◙ Tape & reel dimensions

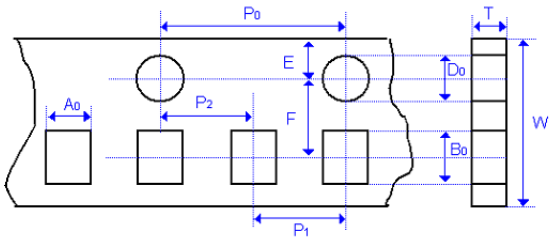


Fig. 2 The dimension of paper tape

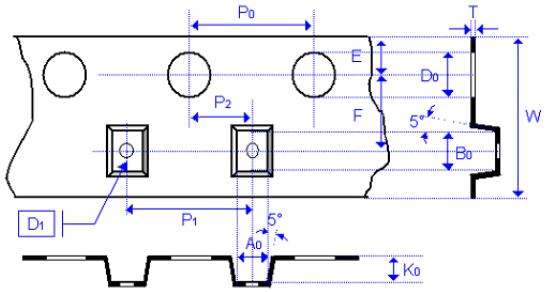


Fig. 3 The dimension of plastic tape

| Size | 0201 | 0402 | 0603 | 0805 | | | 1206 | | | 1210 | | | 1808 | 1812 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thickness | L | N,E | S,H,X | A,H | B,T | D,I | B,T | C,J,D | G,P | T | C,D,G,K | M | D,F, G,K | D,F, G,K | M,U |
| $A_0$ | 0.40 +/-0.10 | 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 | < 3.05 | < 3.20 | < 2.50 | < 3.90 | < 3.90 |
| $B_0$ | 0.70 +/-0.10 | 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 | < 3.80 | <4.00 | < 5.30 | < 5.30 | < 5.30 |
| T | ≦0.55 | ≦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 | 0.23 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 |
| $K_0$ | - | - | - | - | - | < 2.50 | - | < 2.50 | < 2.50 | < 1.50 | < 2.50 | < 3.20 | < 2.50 | < 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 | 8.00 +/-0.30 | 8.00 +/-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 |
| $10xP_0$ | 40.00 +/-0.10 | 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 |
| $P_1$ | 2.00 +/-0.05 | 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 | 4.00 +/-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 +/-0.05 | 2.00 +/-0.05 | 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 |
| $D_1$ | - | - | - | - | - | 1.00 +/-0.10 | - | 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 |
| 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 |
| 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 | 3.50 +/-0.05 | 3.50 +/-0.05 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 |

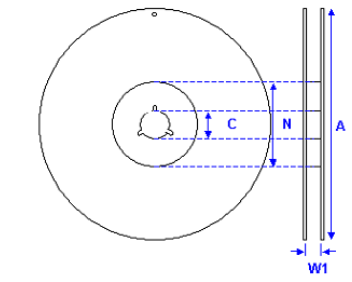


Fig. 4 The dimension of reel

| Size | 0402, 0603, 0805, 1206, 1210 | | | 1808, 1812 |
|---|---|---|---|---|
| Reel size | 7” | 10” | 13” | 7” |
| C | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 |
| $W_1$ | 8.4+1.5/-0 | 8.4+1.5/-0 | 8.4+1.5/-0 | 12.4+2.0/-0 |
| A | 178.0±1.0 | 250.0±1.0 | 330.0±1.0 | 178.0±1.0 |
| N | 60.0+1.0/-0 | 100.0±1.0 | 100±1.0 | 60.0+1.0/-0 |



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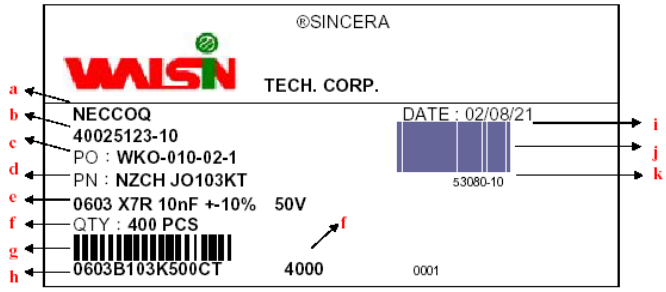
## ◙ Description of customer label




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, Y5V |
|---|---|---|---|---|
| ① | Ceramic material | | $CaZrO_3$ based | $BaTiO_3$ based |
| ② | Inner electrode | | Ni | |
| ③ | Termination | Inner layer | Cu | |
| ④ | | Middle layer | Ni | |
| ⑤ | | Outer layer | Sn | |

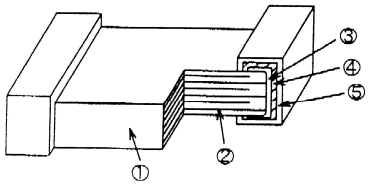



Fig. 5 The construction of MLCC

## ◙ Storage and handling conditions

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

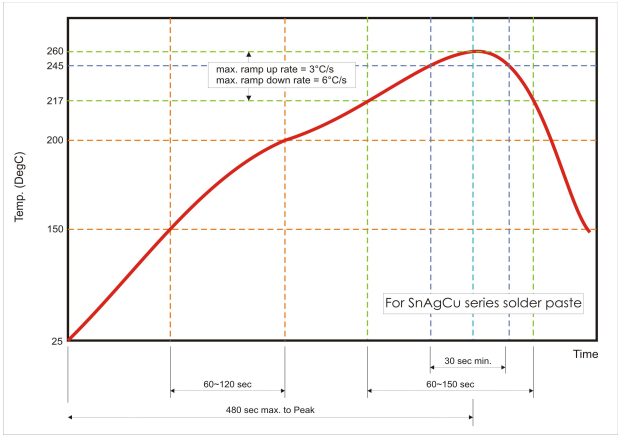


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

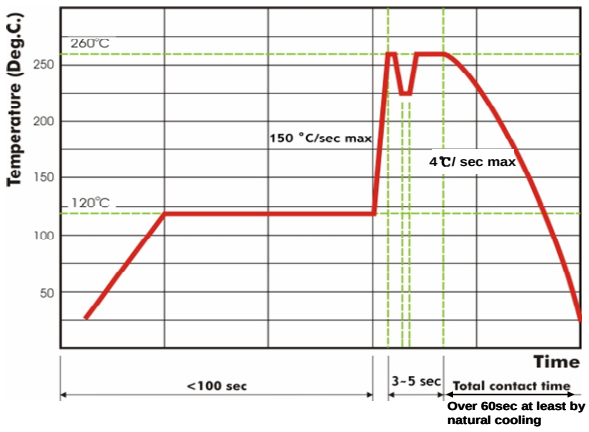


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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