# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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設計驗證
工程課
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## 1. DESCRIPTION

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

WTC's MLCC is made by NP0, X7R, X6S, X7S and X5R dielectric material and which provides product with high electrical precision, stability and reliability.

## 2. FEATURES

a. A wide selection of sizes is available (0201 to 1812).
b. High capacitance in given case size.
c. Capacitor with lead-free termination (pure Tin).

## 3. APPLICATIONS

a. For general digital circuit.
b. For power supply bypass capacitors.
c. For consumer electronics.
d. For telecommunication.

## 4. HOW TO ORDER

| 1206 | B | 104 | K | 500 | C | T |
|---|---|---|---|---|---|---|
| **Size** | **Dielectric** | **Capacitance** | **Tolerance** | **Rated voltage** | **Termination** | **Packaging style** |
| Inch (mm)<br>**0201** (0603)<br>**0402** (1005)<br>**0603** (1608)<br>**0805** (2012)<br>**1206** (3216)<br>**1210** (3225)<br>**1812** (4532) | **N**=NP0<br>(C0G)<br>**B**=X7R<br>**F**=Y5V<br>**X**=X5R<br>**S**=X6S<br>**A**=X7S | 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>104=10x$10^4$<br>=100nF | **A**=±0.05pF<br>**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% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>**4R0**=4 VDC<br>**6R3**=6.3 VDC<br>**100**=10 VDC<br>**160**=16 VDC<br>**250**=25 VDC<br>**350**=35 VDC<br>**500**=50 VDC<br>**101**=100 VDC | **C**=Cu/Ni/Sn | **T**=7" reeled<br>**G**=13" reeled |

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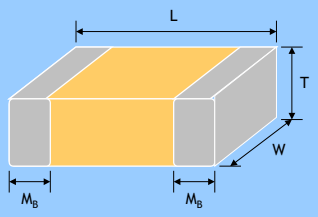
## 5. EXTERNAL DIMENSIONS

| Outline | Size Inch (mm) | L (mm) | W (mm) | T (mm)/Symbol | | Soldering Method * | $M_B$ (mm) |
|---|---|---|---|---|---|---|---|
|  Fig. 1 The outline of MLCC | 01R5 (0402) | 0.4±0.02 | 0.2±0.02 | 0.2±0.02 | V | R | 0.10±0.03 |
| | 0201 (0603) | 0.6±0.03 | 0.3±0.03 | 0.3±0.03 | L | R | 0.15±0.05 |
| | | 0.6±0.05#2 | 0.3±0.05#2 | 0.3±0.05#2 | | | |
| | | 0.6±0.09#3 | 0.3±0.09#3 | 0.3±0.09#3 | | | 0.15+0.1/-0.05 |
| | 0402 (1005) | 1.00±0.05 | 0.50±0.05 | 0.50±0.05 | N | R | 0.25 +0.05/-0.10 |
| | | | | 0.50+0.02/-0.05 | Q | R | |
| | | 1.00±0.20 | 0.50±0.20 | 0.5±0.20 | E | R | |
| | | 1.00±0.15#6 | 0.50±0.15#6 | 0.5±0.15#6 | | | |
| | 0603 (1608) | 1.60±0.10 | 0.80±0.10 | 0.80±0.07 | S | R / W | 0.40±0.15 |
| | | 1.60+0.15/-0.10 | 0.80+0.15/-0.10 | 0.50±0.10 | H | R / W | |
| | | | | 0.80±0.10 | B | R / W | |
| | | | | 0.80+0.15/-0.10 | X | R / W | |
| | | 1.60±0.20#1 | 0.80±0.20#1 | 0.8±0.20#1 | | | |
| | 0805 (2012) | 2.00±0.15 | 1.25±0.10 | 0.50±0.10 | H | R / W | 0.50±0.20 |
| | | | | 0.60±0.10 | A | R / W | |
| | | | | 0.80±0.10 | B | R / W | |
| | | | | 1.25±0.10 | D | R | |
| | | 2.00±0.20 | 1.25±0.20 | 0.85±0.10 | T | R / W | |
| | | | | 1.25±0.20 | I | R | |
| | 1206 (3216) | 3.20±0.15 | 1.60±0.15 | 0.80±0.10 | B | R / W | 0.60±0.20 (0.5±0.25)*** |
| | | | | 0.95±0.10 | C | R | |
| | | | | 1.25±0.10 | D | R | |
| | | 3.20±0.20 | 1.60±0.20 | 1.15±0.15 | J | R | |
| | | | | 1.60±0.20 | G | R | |
| | | | | 0.85±0.10 | T | R / W | |
| | | 3.20+0.30/-0.1 3.30+0.30/-0.1#5 | 1.60+0.30/-0.10 | 1.60+0.30/-0.10 | P | R | |
| | 1210 (3225) | 3.20±0.30 | 2.50±0.20 | 0.95±0.10 | C | R | 0.75±0.25 |
| | | | | 0.85±0.10 | T | R | |
| | | | | 1.25±0.10 | D | R | |
| | | 3.20±0.40 | 2.50±0.30 | 1.60±0.20 | G | R | |
| | | | | 2.00±0.20 | K | R | |
| | | | | 2.50±0.30 | M | R | |
| | | 3.20±0.60#4 | 2.50±0.50#4 | 2.50±0.50#4 | | | |
| | 1808 (4520) | 4.50±0.40 (4.5+0.5/-0.3)** | 2.03±0.25 | 1.25±0.10 | D | R | 0.75±0.25 (0.5±0.25)*** |
| | | | | 1.40±0.15 | F | R | |
| | | | | 1.60±0.20 | G | R | |
| | | | | 2.00±0.20 | K | R | |
| | 1812 (4532) | 4.50±0.40 (4.5+0.5/-0.3)** | 3.20±0.30 | 1.25±0.10 | D | R | 0.75±0.25 (0.5±0.25)*** |
| | | | | 1.60±0.20 | G | R | |
| | | | | 2.00±0.20 | K | R | |
| | | | 3.20±0.40 | 2.50±0.30 | M | R | |
| | | | | 2.80±0.30 | U | R | |

* R = Reflow soldering process ; W = Wave soldering process.
** For 1808/1812/1825_200V~4000V and safety certificated products.
*** For 1206_≧1000V, 1808/1812_200V~4000V and safety certificated products.
#1: For 0603/Cap≧10μF or 0603(≦6.3V)/Cap≧4.7μF or 0603(>10V)/Cap>1μF products,
Excluding 0603X225(16V&25V),0603S225(6.3V&16V),0603X475(6.3V&16V),0603S475(4V&6.3V).
#2: For 0201/ 0.1uF < Cap < 0.68uF products, Excluding 0201X334~474(≦6.3V) & 0201X224(≦10V).
#3: For 0201X334(16V&25V), 0201/Cap≧0.68μF products, Excluding 0201X105*6R3=>(L:0.6±0.05,W:0.3±0.05,T:0.3±0.05).
#4: For 1210(200V&250V)/Cap>0.47μF products.
#5: For 1206(100V)/Cap≧1.2μF products.
#6: For 0402X475M6R3CT products.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## 6. GENERAL ELECTRICAL DATA

| Dielectric | NP0 | X7R | X5R | X6S | X7S |
|---|---|---|---|---|---|
| Size | 0201, 0402, 0603, 0805, 1206, 1210, 1812 | | | | |
| Capacitance range* | 0.1pF to 0.1μF | 100pF to 47μF | 100pF to 220μF | 0.1μF to 100μF | 0.1μF to 100μF |
| Capacitance tolerance** | Cap≤5pF[#1]:<br>A (±0.05pF), B (±0.1pF),<br>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%) | J (±5%),<br>K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V,100V | 4V,6.3V, 10V, 16V, 25V, 35V,50V, 100V | | | |
| Operating temperature | -55 to +125°C | | -55 to +85°C | -55 to +105°C | -55 to +125°C |
| Capacitance characteristic | ±30ppm | ±15% | ±15% | ±22% | ±22% |
| Termination | Ni/Sn (lead-free termination) | | | | |

#1: NP0, 0.1pF product only provide B tolerance; 0603N0R3/0R4 provide B&C tolerance.

* 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/X6S/X5R/X7S: Please refer to page 13 “Reliability test conditions and requirements” for detail.

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

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# 7. CAPACITANCE RANGE

## 7-1. NP0 Dielectric 0201, 0402, 0603, 0805 Sizes

| DIELECTRIC | | NP0 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0201 | | | | | 0402 | | | | | 0603 | | | | | 0805 | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 0.1pF (0R1) | L | L | L | L | L | N | N | N | N | | | | | | | | | | | |
| | 0.2pF (0R2) | L | L | L | L | L | N | N | N | N | | | | | | | | | | | |
| | 0.3pF (0R3) | L | L | L | L | L | N | N | N | N | | S | S | S | S | | | | | | |
| | 0.4pF (0R4) | L | L | L | L | L | N | N | N | N | | S | S | S | S | | | | | | |
| | 0.5pF (0R5) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 0.6pF (0R6) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 0.7pF (0R7) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 0.8pF (0R8) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 0.9pF (0R9) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 1.0pF (1R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 1.2pF (1R2) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 1.5pF (1R5) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 1.8pF (1R8) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 2.0pF (2R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 2.2pF (2R2) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 2.7pF (2R7) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 3.0pF (3R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 3.3pF (3R3) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 3.9pF (3R9) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 4.0pF (4R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 4.7pF (4R7) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 5.0pF (5R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 5.6pF (5R6) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 6.0pF (6R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 6.8pF (6R8) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 7.0pF (7R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 8.0pF (8R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 8.2pF (8R2) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 9.0pF (9R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 10pF (100) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 12pF (120) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 15pF (150) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 18pF (180) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 22pF (220) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 27pF (270) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 33pF (330) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 39pF (390) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 47pF (470) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 56pF (560) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 68pF (680) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 82pF (820) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 100pF (101) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 120pF (121) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 150pF (151) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 180pF (181) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 220pF (221) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | A | A | A | A | A |
| | 270pF (271) | L | L | L | | | N | N | N | N | | S | S | S | S | S | A | A | A | A | A |
| | 330pF (331) | L | L | L | | | N | N | N | N | | S | S | S | S | S | A | A | A | A | A |
| | 390pF (391) | L | L | L | | | N | N | N | N | | S | S | S | S | S | B | B | B | B | B |
| | 470pF (471) | L | L | L | | | N | N | N | N | | S | S | S | S | S | B | B | B | B | B |
| | 560pF (561) | L | L | L | | | N | N | N | N | | S | S | S | S | S | B | B | B | B | B |
| | 680pF (681) | L | L | L | | | N | N | N | N | | S | S | S | S | S | B | B | B | B | B |
| | 820pF (821) | | | L | | | N | N | N | N | | S | S | S | S | S | B | B | B | B | B |
| | 1,000pF (102) | | | L | | | N | N | N | N | | S | S | S | S | S | B | B | B | B | B |
| | 1,200pF (122) | | | | | | | | | | | X | X | X | X | X | B | B | B | B | B |
| | 1,500pF (152) | | | | | | | | | | | X | X | X | X | X | B | B | B | B | B |
| | 1,800pF (182) | | | | | | | | | | | X | X | X | X | X | B | B | B | B | B |
| | 2,200pF (222) | | | | | | | | | | | X | X | X | X | X | B | B | B | B | B |
| | 2,700pF (272) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 3,300pF (332) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 3,900pF (392) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 4,700pF (472) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 5,600pF (562) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 6,800pF (682) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 8,200pF (822) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 0.010uF (103) | | | | | | | | | | | X | X | X | X | X | D | D | D | D | D |
| | 0.012uF (123) | | | | | | | | | | | | | | | | D | D | D | D | D |
| | 0.015uF (153) | | | | | | | | | | | | | | | | D | D | D | D | D |
| | 0.018uF (183) | | | | | | | | | | | | | | | | D | D | D | D | D |
| | 0.022uF (223) | | | | | | | | | | | | | | | | D | D | D | D | D |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed capacitance tolerance "J" (±5%) only.
3. For more information about products with special capacitance or other data, please contact WTC local representative.



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## 7-1. NP0 Dielectric 1206, 1210, 1812 Sizes

| DIELECTRIC | | NP0 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1206 | | | | | 1210 | | | | | 1812 | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 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 |
| | 12pF (120) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 15pF (150) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 18pF (180) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 22pF (220) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 27pF (270) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 33pF (330) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 39pF (390) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 47pF (470) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 56pF (560) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 68pF (680) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 82pF (820) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 100pF (101) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 120pF (121) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 150pF (151) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 180pF (181) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 220pF (221) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 270pF (271) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 330pF (331) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 390pF (391) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 470pF (471) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 560pF (561) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 680pF (681) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 820pF (821) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 1,000pF (102) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 1,200pF (122) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 1,500pF (152) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 1,800pF (182) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 2,200pF (222) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 2,700pF (272) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 3,300pF (332) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 3,900pF (392) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 4,700pF (472) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 5,600pF (562) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| | 6,800pF (682) | C | C | C | C | C | 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) | P | P | P | P | P | D | D | D | D | D | D | D | D | D |
| | 0.015μF (153) | P | P | P | P | P | D | D | D | D | D | D | D | D | D |
| | 0.018μF (183) | P | P | P | P | P | K | K | K | K | K | D | D | D | D |
| | 0.022μF (223) | P | P | P | P | P | K | K | K | K | K | D | D | D | D |
| | 0.027μF (273) | P | P | P | P | | K | K | K | K | K | D | D | D | D |
| | 0.033μF (333) | P | P | P | P | | K | K | K | K | K | D | D | D | D |
| | 0.039μF (393) | P | P | P | P | | K | K | K | K | K | M | M | M | M |
| | 0.047μF (473) | P | P | P | P | | K | K | K | K | K | M | M | M | M |
| | 0.056μF (563) | P | P | P | P | | | | | | | M | M | M | M |
| | 0.068μF (683) | P | P | P | P | | | | | | | M | M | M | M |
| | 0.082μF (823) | P | P | P | P | | | | | | | M | M | M | M |
| | 0.1μF (104) | P | P | P | P | | | | | | | M | M | M | M |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed capacitance tolerance "J" (±5%) only.
3. For more information about products with special capacitance or other data, please contact WTC local representative.



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## 7-2. X7R Dielectric 0201, 0402, 0603, 0805 Sizes

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0201 | | | | | 0402 | | | | | | 0603 | | | | | | 0805 | | | | | | |
| RATED VOLTAGE (VDC) | | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 | 100 | 6.3 | 10 | 16 | 25 | 50 | 100 | 6.3 | 10 | 16 | 25 | 35 | 50 | 100 |
| Capacitance | 100pF (101) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 120pF (121) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 150pF (151) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 180pF (181) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 220pF (221) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 270pF (271) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 330pF (331) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 390pF (391) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 470pF (471) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 560pF (561) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 680pF (681) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 820pF (821) | | | L | L | L | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 1,000pF (102) | L | L | L | L | L | N | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 1,200pF (122) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 1,500pF (152) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 1,800pF (182) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 2,200pF (222) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 2,700pF (272) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 3,300pF (332) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 3,900pF (392) | L | L | L | L | | | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 4,700pF (472) | L | L | L | L | | N | N | N | N | N | N | | S | S | S | S | S | | B | B | B | | B | B |
| | 5,600pF (562) | L | L | L | L | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | | B | B |
| | 6,800pF (682) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | | B | B |
| | 8,200pF (822) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | | B | B |
| | 0.010μF (103) | L | L | L | L | | N | N | N | N | N | | | S | S | S | S | S | | B | B | B | | B | B |
| | 0.012μF (123) | | | | | | | N | N | N | N | | | S | S | S | S | X | | B | B | B | | B | B |
| | 0.015μF (153) | | | | | | | N | N | N | N | | | S | S | S | S | X | | B | B | B | | B | B |
| | 0.018μF (183) | | | | | | | N | N | N | N | | | S | S | S | S | X | | B | B | B | | B | B |
| | 0.022μF (223) | | L | L | | | N | N | N | N | N | | | S | S | S | S | X | | B | B | B | | B | B |
| | 0.027μF (273) | | | | | | | N | N | N | N | | | S | S | S | S | X | | B | B | B | | B | D |
| | 0.033μF (333) | | | | | | | N | N | N | N | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.039μF (393) | | | | | | | N | N | N | N | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.047μF (473) | | | | | | | N | N | N | N | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.056μF (563) | | | | | | | N | N | N | E | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.068μF (683) | | | | | | | N | N | N | E | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.082μF (823) | | | | | | | N | N | N | E | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.10μF (104) | | | | | | N | N | N | N | E | | | S | S | S | X | X | | B | B | B | | B | D |
| | 0.12μF (124) | | | | | | | | | | | | | S | S | X | | | | B | B | B | | B | I |
| | 0.15μF (154) | | | | | | | | N | | | | | S | S | X | X | | | D | D | D | | D | I |
| | 0.18μF (184) | | | | | | | | | | | | | S | S | X | | | | D | D | D | | D | I |
| | 0.22μF (224) | | | | | | N | N | N | N | | | | S | S | X | X | | | D | D | D | | D | I |
| | 0.27μF (274) | | | | | | | | | | | | X | X | X | X | | | | D | D | D | | I | I |
| | 0.33μF (334) | | | | | | N | N | | | | | X | X | X | X | X | | | D | D | D | | I | I |
| | 0.39μF (394) | | | | | | | | | | | | X | X | X | X | | | | D | D | D | | I | I |
| | 0.47μF (474) | | | | | | N | N | | | | | X | X | X | X | X | | | D | D | D | | I | I |
| | 0.56μF (564) | | | | | | | | | | | | X | X | X | | | | | D | D | D | | | |
| | 0.68μF (684) | | | | | | | | | | | | X | X | X | | | | | D | D | D | | I | |
| | 0.82μF (824) | | | | | | | | | | | | X | X | X | | | | | D | D | D | | | |
| | 1.0μF (105) | | | | | | N | | | | | | X | X | X | X | X | | | D | D | D | I | I | |
| | 1.5μF (155) | | | | | | | | | | | | | | | | | | | I | I | I | | | |
| | 2.2μF (225) | | | | | | | | | | | | X | X | X | | | | I | I | I | I | I | I | |
| | 3.3μF (335) | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.7μF (475) | | | | | | | | | | | | X | X | | | | | I | I | I | I | | | |
| | 6.8μF (685) | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10μF (106) | | | | | | | | | | | | | | | | | | I | I | I* | | | | |
| | 22μF (226) | | | | | | | | | | | | | | | | | | | | | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed product not in 10% (code "K") tolerance.



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## 7-2. X7R Dielectric 1206, 1210, 1812 Sizes

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1206 | | | | | | | 1210 | | | | | | | 1812 | | | | |
| RATED VOLTAGE (VDC) | | 6.3 | 10 | 16 | 25 | 35 | 50 | 100 | 6.3 | 10 | 16 | 25 | 35 | 50 | 100 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 100pF (101) | | | | | | | | | | | | | | | | | | | |
| | 120pF (121) | | | | | | | | | | | | | | | | | | | |
| | 150pF (151) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 180pF (181) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 220pF (221) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 270pF (271) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 330pF (331) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 390pF (391) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 470pF (471) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 560pF (561) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 680pF (681) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 820pF (821) | | B | B | B | | B | B | | | | | | | | | | | | |
| | 1,000pF (102) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 1,200pF (122) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 1,500pF (152) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 1,800pF (182) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 2,200pF (222) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 2,700pF (272) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 3,300pF (332) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 3,900pF (392) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 4,700pF (472) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 5,600pF (562) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 6,800pF (682) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 8,200pF (822) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.010μF (103) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.012μF (123) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.015μF (153) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.018μF (183) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.022μF (223) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.027μF (273) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.033μF (333) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.039μF (393) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.047μF (473) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.056μF (563) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.068μF (683) | | B | B | B | | B | B | | C | C | C | | C | C | D | D | D | D | D |
| | 0.082μF (823) | | B | B | B | | B | D | | C | C | C | | C | C | D | D | D | D | D |
| | 0.10μF (104) | | B | B | B | | B | C | | C | C | C | | C | C | D | D | D | D | D |
| | 0.12μF (124) | | B | B | B | | B | D | | C | C | C | | C | C | D | D | D | D | D |
| | 0.15μF (154) | | C | C | C | | C | G | | C | C | C | | C | D | D | D | D | D | D |
| | 0.18μF (184) | | C | C | C | | C | G | | C | C | C | | C | D | D | D | D | D | D |
| | 0.22μF (224) | | C | C | C | | C | G | | C | C | C | | C | D | D | D | D | D | D |
| | 0.27μF (274) | | C | C | C | | D | G | | C | C | C | | C | G | D | D | D | D | D |
| | 0.33μF (334) | | C | C | C | | D | G | | C | C | C | | D | G | D | D | D | D | D |
| | 0.39μF (394) | | C | C | J | | P | G | | C | C | C | | D | M | D | D | D | D | D |
| | 0.47μF (474) | | J | J | J | | P | G | | C | C | C | | D | M | D | D | D | D | K |
| | 0.56μF (564) | | J | J | J | | P | P | | D | D | D | | D | M | D | D | D | D | K |
| | 0.68μF (684) | | J | J | J | | P | P | | D | D | D | | D | K | D | D | D | K | K |
| | 0.82μF (824) | | J | J | J | | P | P | | D | D | D | | D | K | D | D | D | K | K |
| | 1.0μF (105) | | J | J | J | | P | P | | D | D | D | | D | K | D | D | D | K | K |
| | 1.5μF (155) | J | J | J | P | | P | | | | G | G | | M | M | D | D | D | K | K |
| | 2.2μF (225) | J | J | J | P | | P | P | | | G | G | | M | M | G | G | G | M | M |
| | 3.3μF (335) | | P | P | P | | P | | | | G | G | | M | | K | K | K | K | |
| | 4.7μF (475) | P | P | P | P | | P | | | K | K | K | | M | M | M | M | M | M | |
| | 6.8μF (685) | | | | | | | | | | | | | | | M | M | M | M | |
| | 10μF (106) | P | P | P | P | P | | | K | K | K | K | M | M | | M | M | M | M | |
| | 22μF (226) | P | P | P* | | | | | | M | M | M | | | | M | M | M | | |
| | 47μF (476) | | | | | | | | M | M | | | | | | | | | | |
| | 100μF (107) | | | | | | | | | | | | | | | | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed product not in 10% (code "K") tolerance.



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## 7-3. X5R Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

| Dielectric | | X5R | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | 0201 | | | | | 0402 | | | | | | | 0603 | | | | | |
| Rated Voltage (VDC) | | 6.3 | 10 | 16 | 25 | 50 | 4 | 6.3 | 10 | 16 | 25 | 50 | 63 | 4 | 6.3 | 10 | 16 | 25 | 35 | 50 |
| Capacitance | 100pF (101) | | | L | L | L | | | | | | | | | | | | | | |
| | 150pF (151) | | | L | L | L | | | | | | | | | | | | | | |
| | 220pF (221) | | | L | L | L | | | | | | | | | | | | | | |
| | 330pF (331) | | | L | L | L | | | | | | | | | | | | | | |
| | 470pF (471) | | | L | L | L | | | | | | | | | | | | | | |
| | 680pF (681) | | | L | L | L | | | | | | | | | | | | | | |
| | 820pF (821) | | | L | L | L | | | | | | | | | | | | | | |
| | 1,000pF (102) | | L | L | L | L | | | | | | | | | | | | | | |
| | 1,500pF (152) | | L | L | L | | | | | | | | | | | | | | | |
| | 2,200pF (222) | | L | L | L | | | | | | | | | | | | | | | |
| | 2,700pF (272) | | L | L | L | | | | | | | | | | | | | | | |
| | 3,300pF (332) | | L | L | L | | | | | | | | | | | | | | | |
| | 4,700pF (472) | | L | L | L | | | | | | | | | | | | | | | |
| | 6,800pF (682) | | L | L | L | | | | | | | | | | | | | | | |
| | 0.010μF (103) | L | L | L | L | L | | | | | | | | | | | | | | |
| | 0.015μF (153) | L | L | | | | | | | | | N | | | | | | | | |
| | 0.022μF (223) | L | L | L | L | | | | | | N | N | | | | | | | | |
| | 0.033μF (333) | L | L | | | | | | | N | | N | | | | | | | | |
| | 0.047μF (473) | L | L | L | L | | | N | N | N | | N | | | | | | | | |
| | 0.068μF (683) | L | L | | | | | N | N | N | | E | | | | | | | | |
| | 0.082μF (823) | L | L | | | | | N | N | N | | E | | | | | | | | |
| | 0.10μF (104) | L | L | L | L | | | N | N | N | N | E | | | | | | | | |
| | 0.15μF (154) | | | | | | | N | N | N | N | | | | | | | | | |
| | 0.22μF (224) | L | L | L | L | | | N | N | N | N | N | N | | X | X | X | X | | |
| | 0.33μF (334) | L | L | L | L | | | N | N | N | N | | | | X | X | X | X | | |
| | 0.47μF (474) | L | L | | | | | N | N | N | N | E | | | X | X | X | X | | X |
| | 0.68μF (684) | | | | | | | N | N | | | | | | X | X | X | X | | |
| | 0.82uF (824) | | | | | | | | | | | | | | X | X | X | X | | |
| | 1.0μF (105) | L | L* | L* | | | | N | N | N | N | E | | | X | X | X | X | X | X |
| | 1.5μF (155) | | | | | | | | | | | | | | X | X | | | | |
| | 2.2μF (225) | L* | L* | | | | | N | N | E | E | | | | X | X | X | X | | X |
| | 3.3μF (335) | | | | | | | | | | | | | | X | X | | | | |
| | 4.7μF (475) | | | | | | | E | E | E* | | | | | X | X | X | X | | |
| | 6.8uF (685) | | | | | | | | | | | | | | | | | | | |
| | 10μF (106) | | | | | | E* | E* | E* | | | | | X | X | X | X | X | | |
| | 22μF (226) | | | | | | E* | E* | | | | | | X* | X* | X* | | | | |
| | 47μF (476) | | | | | | | | | | | | | X* | X* | | | | | |

| Dielectric | | X5R | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | 0805 | | | | | | 1206 | | | | | | 1210 | | | | | | |
| Rated Voltage (VDC) | | 4 | 6.3 | 10 | 16 | 25 | 50 | 4 | 6.3 | 10 | 16 | 25 | 50 | 4 | 6.3 | 10 | 16 | 25 | 35 | 50 |
| Capacitance | 1.0μF (105) | | | D | D | D | I | | | | | | P | | | | | | | |
| | 1.5μF (155) | | I | I | I | I | | | | J | J | P | P | | | K | K | | | |
| | 2.2μF (225) | | I | I | I | I | I | | | J | J | P | P | | | K | K | | | |
| | 3.3μF (335) | | I | I | I | I | | | | P | P | P | P | | | | | | | |
| | 4.7μF (475) | | I | I | I | I | I | | P | P | P | P | P | | | K | K | K | | |
| | 6.8uF (685) | | | | | | | | P | P | | | | | | | | | | |
| | 10μF (106) | | I | I | I | I | I | | P | P | P | P | P | | K | K | K | K | M | M |
| | 22μF (226) | | I | I* | I* | I* | | | P | P | P | P | | | M | M | M | M | M | |
| | 47μF (476) | I* | I* | I* | | | | | P* | P* | P* | | | | M | M | M | M* | | |
| | 100μF (107) | I* | I* | | | | | | P | | | | | | M* | M* | M* | | | |
| | 220μF (227) | | | | | | | P* | P* | | | | | M* | M* | | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed product not in 10% (code "K") tolerance.



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## 7-5. X6S Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

| Dielectric | | X6S | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | 0201 | | | | | 0402 | | | | 0603 | | | | | 0805 | | | | | | 1206 | | | | | 1210 | | | | |
| Rated Voltage (VDC) | | 4 | 6.3 | 10 | 16 | 25 | 6.3 | 10 | 16 | 25 | 4 | 6.3 | 10 | 16 | 25 | 4 | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 |
| Capacitance | 0.10μF (104) | L | L | L | L | L | N | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.15μF (154) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.22μF (224) | | L | L* | | | N | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.33μF (334) | | | | | | N | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.47μF (474) | L | | | | | N | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.68μF (684) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.0μF (105) | L* | L* | | | | N | N | N | E | | | | | | | | | | | | | | | | | | | | | |
| | 1.5μF (155) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.2μF (225) | | | | | | E | E | E | | | X | X | X | X | | | | I | | | | | | | | | | | | |
| | 3.3μF (335) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.7μF (475) | | | | | | E | E | | | X | X | X | X | X | | | | | I | I | | | | | | | | | | |
| | 6.8uF (685) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10μF (106) | | | | | | E* | | | | X* | X* | X* | X* | | I | I | I | I | I | | | | | P | | | | | | |
| | 22μF (226) | | | | | | | | | | X* | X* | | | | I* | I* | I* | I* | | | | P | P* | P | | | | | | M |
| | 47μF (476) | | | | | | | | | | | | | | | I* | I* | | | | | P | | | | | M | M | M | | |
| | 100μF (107) | | | | | | | | | | | | | | | | | | | | | | | | | | M* | M* | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed product not in 10% (code "K") tolerance.

## 7-6. X7S Dielectric 0402, 0603, 0805, 1206, 1210 Sizes

| Dielectric | | X7S | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | 0201 | 0402 | | | 0603 | | | | 0805 | | | | | 1206 | | | | | 1210 | | | | | |
| Rated Voltage (VDC) | | 10V | 6.3 | 10 | 16 | 6.3 | 10 | 16 | 25 | 10 | 16 | 25 | 50 | 100 | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 |
| Capacitance | 0.1μF (104) | L | | | | | | | | | | | | I | | | | | | | | | | |
| | 1.0μF (105) | | | E | | | | X | | | | | | | | | | | | | | | | |
| | 1.5μF (155) | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.2μF (225) | | E | E | | | | | X | | | | | | | | | | | | | | | |
| | 3.3μF (335) | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.7μF (475) | | | | | | X | X | | | | | I | | | | | | | | | | | |
| | 6.8uF (685) | | | | | | | | | | | | | | | | | | | | | | | |
| | 10μF (106) | | | | | | | | | | | I | I | | | | | | | | | | | |
| | 22μF (226) | | | | | | | | | | | | | | | | P* | | | | | | | |
| | 47μF (476) | | | | | | | | | | | | | | P* | | | | | | | | | |
| | 100μF (107) | | | | | | | | | | | | | | | | | | | M* | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed product not in 10% (code "K") tolerance.


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## 8. PACKAGING STYLE AND QUANTITY

| Size | Thickness (mm)/Symbol | | Paper tape | | Plastic tape | |
|---|---|---|---|---|---|---|
| | | | 7" reel | 13" reel | 7" reel | 13" reel |
| 0201 (0603) | 0.30±0.03 | L | 15,000 | 70,000 | - | - |
| | 0.30±0.05 | L | 15,000 | 50,000 | - | - |
| | 0.30±0.09 | L | 15,000 | 50,000 | - | - |
| 0402 (1005) | 0.50±0.05 | N | 10,000 | 50,000 | - | - |
| | 0.50+0.02/-0.05 | Q | 10,000 | 50,000 | - | - |
| | 0.50±0.20 | E | 10,000 | - | - | - |
| 0603 (1608) | 0.50±0.10 | H | 4,000 | - | - | - |
| | 0.80±0.07 | S | 4,000 | 15,000 | - | - |
| | 0.80+0.15/-0.10 | X | 4,000 | 15,000 | - | - |
| 0805 (2012) | 0.50±0.10 | H | 4,000 | 15,000 | - | - |
| | 0.60±0.10 | A | 4,000 | 15,000 | - | - |
| | 0.80±0.10 | B | 4,000 | 15,000 | - | - |
| | 0.85±0.10 | T | 4,000 | 15,000 | - | - |
| | 1.25±0.10 | D | - | - | 3,000 | 10,000 |
| | 1.25±0.20 | I | - | - | 3,000 | 10,000 |
| 1206 (3216) | 0.80±0.10 | B | 4,000 | 15,000 | - | - |
| | 0.85±0.10 | T | 4,000 | 15,000 | - | - |
| | 0.95±0.10 | C | - | - | 3,000 | 10,000 |
| | 1.15±0.15 | J | - | - | 3,000 | 10,000 |
| | 1.25±0.10 | D | - | - | 3,000 | 10,000 |
| | 1.60±0.20 | G | - | - | 2,000 | 10,000 |
| | 1.60+0.30/-0.10 | P | - | - | 2,000 | 9,000 |
| 1210 (3225) | 0.85±0.10 | T | - | - | 3,000 | 10,000 |
| | 0.95±0.10 | C | - | - | 3,000 | 10,000 |
| | 1.25±0.10 | D | - | - | 3,000 | 10,000 |
| | 1.60±0.20 | G | - | - | 2,000 | - |
| | 2.00±0.20 | K | - | - | 1,000 | 6,000 |
| | 2.50±0.30 | M | - | - | 1,000 | 6,000 |
| 1808 (4520) | 1.25±0.10 | D | - | - | 2,000 | 10,000 |
| | 1.40±0.15 | F | - | - | 2,000 | 10,000 |
| | 1.60±0.20 | G | - | - | 2,000 | 8,000 |
| | 2.00±0.20 | K | - | - | 1,000 | 6,000 |
| 1812 (4532) | 1.25±0.10 | D | - | - | 1,000 | 5,000 |
| | 1.60±0.20 | G | - | - | 1,000 | - |
| | 2.00±0.20 | K | - | - | 1,000 | - |
| | 2.50±0.30 | M | - | - | 500 | 3,000 |
| | 2.80±0.30 | U | - | - | 500 | - |

Unit: pieces


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# 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.<br>*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#1:<br>0201≧224 (6.3V,10V,16V),<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);224(16V),<br>0402X475M6R3, 0402X106M100<br>(1.0±0.2Vrms，1KHz±10%)<br><br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</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></td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</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>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧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; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</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>
X5R:
<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</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; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.047μF; 0603>0.1μF; 0805≧1μF;1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>≦12.5%</td><td>1206=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; 0805≧1μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201>0.01μF; 0402≧0.10μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧10μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF;0805=10μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≦3.5%</td><td>≦5%</td><td>0201=0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201>0.01uF; 0402≧ 0.22uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧1μF;0805=10μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.22μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF; 01R5/X5R</td></tr>
<tr><td>≦12.5%</td><td>0805=10μF</td></tr>
<tr><td>≦15%</td><td>0201>0.1μF; 0402≧1μF; 0603≧10μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201>0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</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>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



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<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td></td><td>Q/ D.F.<br>(Dissipation<br>Factor)</td><td></td><td>X6S:
<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</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≦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;<br>1206≧2.2μF;1210≧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;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.10μF;0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF;0805=10μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF;0402≧0.033μF;0603≧0.15μF;<br>0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1uF; 0402≧0.22uF;<br>0603>0.47μF; 0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402=1μF;0805=10μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.22μF;<br>0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0805=10μF</td></tr>
<tr><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≧0.47μF; 0603≧10μF;<br>0805≧4.7μF;1206≧47μF; 1210≧100μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td></td><td></td><td>---</td><td>---</td></tr>
</table>
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</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≦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;<br>1206≧2.2μF;1210≧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;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF;0402≧0.10μF;0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF;0402≧0.033μF;0603≧0.15μF;<br>0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1uF; 0402≧ 0.22uF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.22μF;<br>0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><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;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td></td><td></td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Dielectric<br>Strength</td><td>* To apply voltage (≤100V) 250%.<br>* Duration: 1 to 5 sec.<br>* Charge and 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°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



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<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>*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,Y5V:)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">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 ; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>All X6S items, All X7S items</td><td rowspan="9">RxC≧50 Ω-F.</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</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>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°C at 25°C</td></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X7S</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>
</table>
<table>
<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>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>
*Before initial measurement (Class II only): To apply de-aging at 150°C 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>0201X224/10V~25V: 0.5V</td><td>*0201B104/6.3V~10V: 0.3V<br>0201S104/6.3V~16V: 0.3V<br>0201S224/6.3V: 0.3V<br>0201X334/474/105-6.3V&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>0402B334/474-6.3V&10V: 0.5V<br>0402S334/474-6.3V: 0.5V<br>0402X225/475-6.3V: 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<br>1206A476-6.3V: 0.1V<br>1210S107-6.3V: 0.2V</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.


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| No. | Item | Test Condition | Requirements |
|---|---|---|---|
| 7. | **Adhesive Strength of Termination** | * Pressurizing force：<br>2N (0201) and 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>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>*Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. | * 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 metalized 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 1 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°C 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. | * 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.) |
| 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): To apply de-aging at 150°C 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°C for 1hr then set for 24±2 hrs at room temp. | * 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. |
| 12. | **Temperature Cycle** | * Conduct the five cycles according to the temperatures and time.<br>Step / Temp. (°C) / Time (min.)<br>1 / Min. operating temp. +0/-3 / 30±3<br>2 / Room temp. / 2~3<br>3 / Max. operating temp. +3/-0 / 30±3<br>4 / Room temp. / 2~3<br>*Before initial measurement (Class II only): To apply de-aging at 150°C 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°C for 1hr then set for 24±2 hrs at room temp. | * 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. |

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.


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<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°C<br>*Humidity: 90~95%RH<br>*Test time: 500+24/-0hrs.<br>*Before initial measurement (Class II only): To apply de-aging at 150°C 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°C 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>**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="4">≧ 100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</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;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>≦20%</td><td>0402≧0.33μF</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</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<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;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</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="8">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 ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.


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<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°C<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°C 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°C 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>**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;<br>Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%<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="4">≧ 100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</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;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>≦20%</td><td>0402≧0.33μF</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</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<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;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</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="6">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 ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



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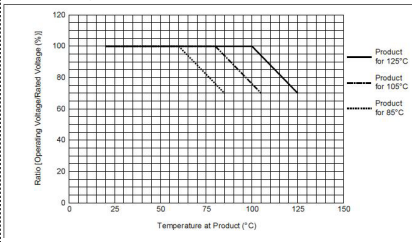
<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>
*Test temp. :<br>NP0, X7R/X7E/X7S: 125±3°C<br>X6S: 105±3°C<br>X5R, 85±3°C<br>
*Test time: 1000+24/-0 hrs.<br>
*To apply voltage:<br>
(1) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td>01R5</td><td>X5R</td><td>=10V</td><td>C=0.1μF</td></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="4">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</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 rowspan="5">0805</td><td>X7R</td><td>35V</td><td>C≧1.0μF</td></tr>
<tr><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>
<tr><td>TT15</td><td>X5R</td><td>6.3V</td><td>C >1.0μF</td></tr>
<tr><td>TT21</td><td>X5R/X7R/X6S</td><td>≦10V</td><td>C≧10μF</td></tr>
</table>
**1WV items must follow de-rating conditions.<br>
#1. 0603X106/475(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>0201</td><td>X5R/X6S</td><td>16V,25V</td><td>C=0.1μF</td></tr>
<tr><td rowspan="2">0402</td><td>X7R</td><td>16V</td><td>C≧0.022μF</td></tr>
<tr><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>X7R/X5R/ 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 rowspan="2">1812</td><td rowspan="2">X7R</td><td>≦50V</td><td>C≧4.7μF</td></tr>
<tr><td>100V</td><td>C≧1.0μF</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 or TT series:150% of rated voltage.<br>
(4) 10V~250V: 200% of rated voltage. Excluding 1812/NP0(250V)/104:100% 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<br>
1210/X7R(2kV)/103:110% of rated voltage.<br>
1210/NP0(1kV)/333:100% of rated voltage.<br>
1812/NP0(1kV)/472~562:100% of rated voltage.<br>
(8) Ur=3.5kV & 4kV: 110% of rated voltage.<br><br>
* Before initial measurement (Class II only): To apply de-aging at 150°C 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°C for 1hr then set for 24±2 hrs at room temp.
</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>
**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="2">≧ 100V</td><td rowspan="2">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td rowspan="5">50V</td><td rowspan="5">≦3%</td><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01μF; 0402≧0.012μF;1210≧3.3μF</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>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</td></tr>
<tr><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;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>≦20%</td><td>0402≧0.33μF</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</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<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;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</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 ; All X6S/X7S items; Size≥1812</td><td></td></tr>
</table>
** De-rating conditions:<br>


The general MLCC products are designed for use in devices with a typical lifetime around 10 years.<br>
The general MLCC products are designed so that the useful lifetime can be extended longer than 10 years under the following conditions:<br>
「80% of the rated voltage or less, Maximum operating temperature -20 degree C or less」<br>
Extended useful lifetime, under specific operating conditions, can be estimated from the chart.<br>
※The useful lifetime is the time when cumulative failure rate becomes 1%.<br>
※Please note that the useful lifetime data is for reference only and not guaranteed.
</td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



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# APPENDIXES

## ◙ Tape & reel dimensions

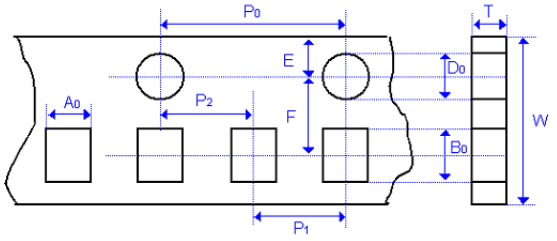



Fig. 2 The dimension of paper tape

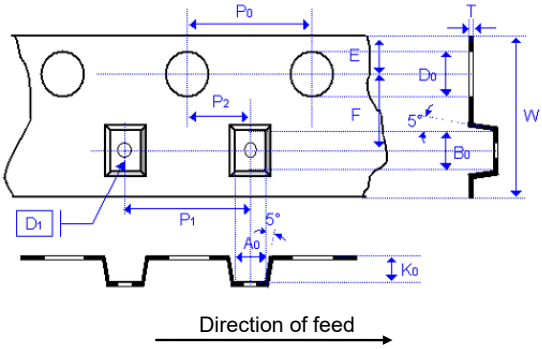



Fig. 3 The dimension of plastic tape

| 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 | < 3.05 | < 3.20 | < 2.50 | < 2.50 | < 3.90 | < 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 | < 3.80 | <4.00 | < 5.30 | < 5.30 | < 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 | 0.23 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 |
| $K_0$ | 0.44 +/-0.05 | - | - | - | - | < 2.50 | - | < 2.50 | < 2.50 | < 1.50 | < 2.00 | < 2.50 | < 3.20 | < 2.50 | < 2.50 | < 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 | 8.00 +/-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 |
| $10xP_0$ | 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 | 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 | 4.00 +/-0.10 | 4.00 +/-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 +/-0.05 | 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 |
| $D_0$ | 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 |
| $D_1$ | - | - | - | - | - | 1.00 +/-0.10 | - | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-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 |
| 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 | 3.50 +/-0.05 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 |

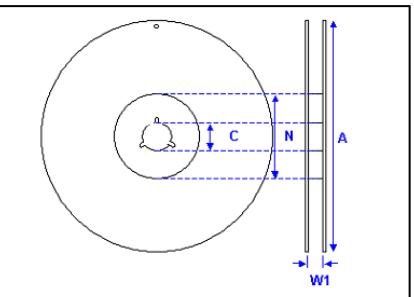
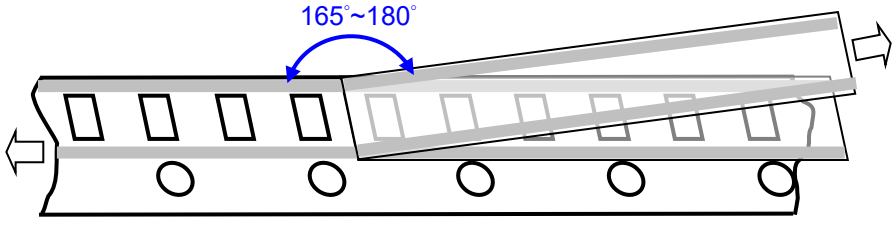



Fig. 4 The dimension of reel

| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | | 1812 |
|---|---|---|---|---|
| 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 |

## ◙ Peeling force (EIA-481)

Peel-off force should be in the range of 10 grams to 100 grams at a peel-off speed of 300±10 mm/min.



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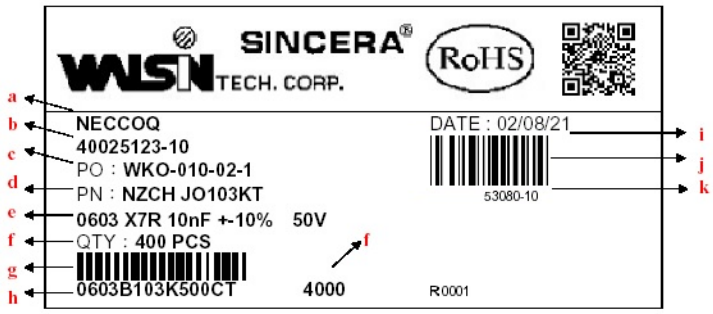
## ◙ Example of customer label




*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 | | NPO | X7R, X5R, X6S, X7S |
|---|---|---|---|---|
| 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 | |

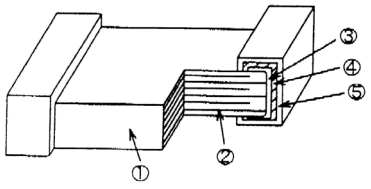



Fig. 5 The construction of MLCC

## ◙ Storage and handling conditions

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

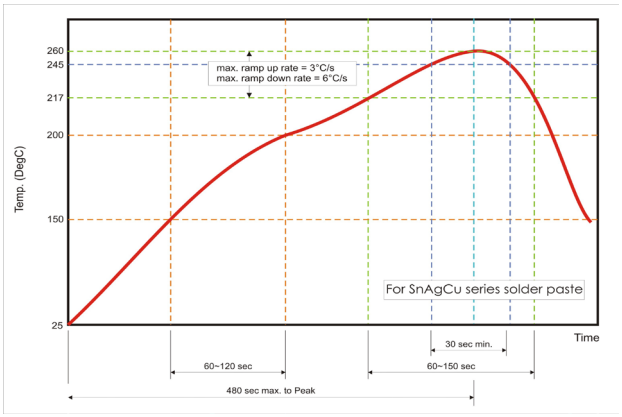


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

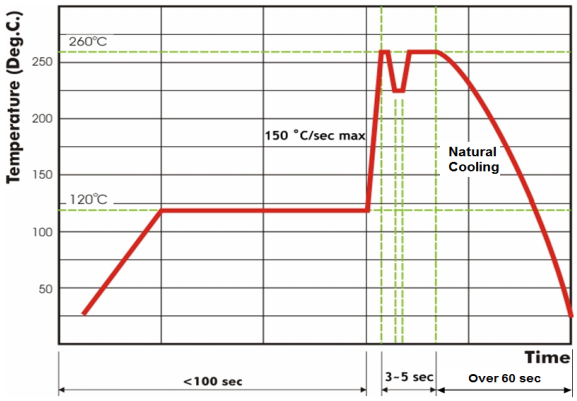


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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