

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MG)

0201 to 1812 Sizes

NP0, X7R, X5R, Dielectrics,

6.3V to 1000V

Halogen Free & RoHS Compliance



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

Multilayer Ceramic Capacitors

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 MG series MLCC is made by NP0, X7R & X5R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MG series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications.

2. FEATURES

- a. A wide selection of sizes is available (0402 to 1812).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

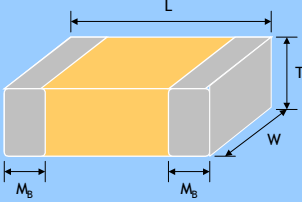
- a. For Navigation & Information equipments.
- b. For entertainment equipments
- c. For comfortable equipments.

4. HOW TO ORDER

| <u>MG</u> | <u>31</u> | <u>B</u> | <u>104</u> | <u>K</u> | <u>500</u> | <u>C</u> | <u>I</u> |
|--|--|---|---|--|--|--------------------|---|
| <u>Series</u> | <u>Size</u> | <u>Dielectric</u> | <u>Capacitance</u> | <u>Tolerance</u> | <u>Rated voltage</u> | <u>Termination</u> | <u>Packaging style</u> |
| MG= Automotive (without AEC-Q200 certification) | 03= 0201 (0603) 15= 0402 (1005) 18= 0603 (1608) 21= 0805 (2012) 31= 1206 (3216) 32= 1210 (3225) 43= 1812 (4532) | N= NP0 (C0G) B= X7R X= X5R | Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 104=10x10 ⁴ =100nF | B= ±0.1pF C= ±0.25pF D= ±0.5pF F= ±1% G= ±2% J= ±5% K= ±10% M= ±20% | Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3= 6.3 VDC 100= 10 VDC 160= 16 VDC 250= 25 VDC 500= 50 VDC 101= 100 VDC 201= 200 VDC 251= 250 VDC 501= 500 VDC 631= 630 VDC 102= 1000 VDC | C= Cu/Ni/Sn | T= 7" reeled 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) | |
|---|---|-------------------------|-------------------------|------------------------|--------------------|--|--|
|  <p>Fig. 1 The outline of MLCC</p> | 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} | | | 0.15±0.1/-0.05 |
| | | 0.6±0.09 ^{#3} | 0.3±0.09 ^{#3} | 0.3±0.09 ^{#3} | | | |
| | 0402 (1005) | 1.00±0.05 | 0.50±0.05 | 0.50±0.05 | N | R | 0.25 |
| | | | | 0.50+0.02/-0.05 | Q | R | |
| | | 1.00±0.20 | 0.50±0.20 | 0.5±0.20 | E | R | +0.05/-0.10 |
| | 0603 (1608) | 1.60+0.15/-0.10 | 0.80+0.15/-0.10 | 0.80±0.07 | S | R / W | 0.40±0.15 |
| | | | | 0.50±0.10 | H | R / W | |
| | | 1.60±0.20 ^{#1} | 0.80±0.20 ^{#1} | 0.80+0.15/-0.10 | X | R / W | |
| | 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 | |
| | | 1.15±0.15 | J | R | | | |
| 3.20±0.20 | | 1.60±0.20 | 1.60±0.20 | G | R | | |
| | | | 0.85±0.10 | T | R / W | | |
| 1210 (3225) | 3.20+0.30/-0.10 | 1.60+0.30/-0.10 | 1.60+0.30/-0.10 | P | R | 0.75±0.25 | |
| | | | 0.95±0.10 | C | R | | |
| | 3.20±0.30 | 2.50±0.20 | 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 | | |
| | | | 2.50±0.30 | M | R | | |
| | | | 2.80±0.30 | U | R | | |
| | | 3.20±0.40 | | | | | |

* 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.
 #2: For 0201/ 0.1uF < Cap < 0.68uF products.
 #3: For 0201/Cap ≥ 0.68μF products.
 #4: For 1210(100V)/Cap > 1μF or 1210(250V)/Cap > 0.47μF or 1210(400V~630V)/Cap > 0.22μF.

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6. GENERAL ELECTRICAL DATA

| | | | |
|-----------------------------------|--|----------------|---------------------|
| Dielectric | NP0 | X7R | X5R |
| Size | 0201, 0402, 0603, 0805, 1206, 1210, 1812 | | |
| Capacitance range* | 0.1pF to 0.033μF | 100pF to 2.2μF | 0.056μF to 10μF |
| Capacitance tolerance** | Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%) | | |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V | | 6.3V, 10V, 16V, 25V |
| Tan δ* | Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000 | Note 1 | |
| Operating temperature | -55 to +125°C | | -55 to +85°C |
| Capacitance characteristic | ±30ppm/°C | | ±15% |
| Termination | Ni/Sn (lead-free termination) | | |

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

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature
Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature for X7R, X5R.

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

Note 1: X7R/X5R

| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | |
|------------|--------|---------------------|--|
| ≥ 100V | ≤ 2.5% | ≤ 3% | 1206 ≥ 0.47μF |
| | | ≤ 5% | 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series |
| | | ≤ 10% | 0805 > 0.22μF; 1210 ≥ 3.3μF |
| 50V | ≤ 2.5% | ≤ 3% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF |
| | | ≤ 5% | 0201 ≥ 0.01μF; 1210 ≥ 4.7μF |
| | | ≤ 10% | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF(0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series |
| 35V | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF |
| 25V | ≤ 3.5% | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF |
| | | ≤ 7% | 0603 ≥ 0.33μF |
| | | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF |
| | | ≤ 12.5% | 0402 ≥ 0.47μF |
| 16V | ≤ 3.5% | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF |
| | | ≤ 10% | 0201 ≥ 0.1μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; TT series 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF |
| | | ≤ 15% | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5 |
| 10V | ≤ 5% | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series |
| | | ≤ 20% | 0402 ≥ 2.2μF |
| 6.3V | ≤ 10% | --- | --- |
| 4V | ≤ 15% | --- | --- |

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7. CAPACITANCE RANGE (NP0 Dielectric)

NP0 Dielectric 0201, 0402, 0603 Sizes

| DIELECTRIC | NP0 | | | | | | | | | | | | | | | | |
|---------------|---------------|------|----|----|----|------|----|----|----|-----|------|----|----|----|-----|-----|-----|
| | SIZE | 0201 | | | | 0402 | | | | | 0603 | | | | | | |
| | RATED VOLTAGE | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance | 0.1pF (0R1) | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.2pF (0R2) | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.3pF (0R3) | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.4pF (0R4) | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.5pF (0R5) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.6pF (0R6) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.7pF (0R7) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.8pF (0R8) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.9pF (0R9) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.0pF (1R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.2pF (1R2) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.5pF (1R5) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.8pF (1R8) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 2.0pF (2R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 2.2pF (2R2) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 2.7pF (2R7) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 3.0pF (3R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 3.3pF (3R3) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 3.9pF (3R9) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 4.0pF (4R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 4.7pF (4R7) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 5.0pF (5R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 5.6pF (5R6) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 6.0pF (6R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 6.8pF (6R8) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 7.0pF (7R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 8.0pF (8R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 8.2pF (8R2) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 9.0pF (9R0) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 10pF (100) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 12pF (120) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 15pF (150) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 18pF (180) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 22pF (220) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 27pF (270) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 33pF (330) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 39pF (390) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 47pF (470) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 56pF (560) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 68pF (680) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 82pF (820) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 100pF (101) | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 120pF (121) | | | | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 150pF (151) | | | | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 180pF (181) | | | | | N | N | N | N | N | S | S | S | S | S | S | S |
| 220pF (221) | | | | | N | N | N | N | N | S | S | S | S | S | S | S | |
| 270pF (271) | | | | | N | N | N | N | N | S | S | S | S | S | X | X | |
| 330pF (331) | | | | | N | N | N | N | N | S | S | S | S | S | X | X | |
| 390pF (391) | | | | | N | N | N | N | N | S | S | S | S | S | X | X | |
| 470pF (471) | | | | | N | N | N | N | N | S | S | S | S | S | X | X | |
| 560pF (561) | | | | | N | N | N | N | N | S | S | S | S | S | | | |
| 680pF (681) | | | | | N | N | N | N | N | S | S | S | S | S | | | |
| 820pF (821) | | | | | N | N | N | N | N | S | S | S | S | S | | | |
| 1,000pF (102) | | | | | N | N | N | N | N | S | S | S | S | S | | | |
| 1,200pF (122) | | | | | | | | | | X | X | X | X | | | | |
| 1,500pF (152) | | | | | | | | | | X | X | X | X | | | | |
| 1,800pF (182) | | | | | | | | | | X | X | X | X | | | | |
| 2,200pF (222) | | | | | | | | | | X | X | X | X | | | | |
| 2,700pF (272) | | | | | | | | | | X | X | X | X | | | | |
| 3,300pF (332) | | | | | | | | | | X | X | X | X | | | | |
| 3,900pF (392) | | | | | | | | | | | | | | | | | |
| 4,700pF (472) | | | | | | | | | | | | | | | | | |
| 5,600pF (562) | | | | | | | | | | | | | | | | | |
| 6,800pF (682) | | | | | | | | | | | | | | | | | |
| 8,200pF (822) | | | | | | | | | | | | | | | | | |
| 0.01μF (103) | | | | | | | | | | | | | | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors
NP0 Dielectric 0805 Size (Continued)

| DIELECTRIC | | NP0 | | | | | | | | |
|---------------|-------------|------|----|----|----|-----|-----|-----|-----|-----|
| SIZE | | 0805 | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 |
| Capacitance | 0.5pF (0R5) | A | A | A | A | A | A | A | A | A |
| | 0.6pF (0R6) | A | A | A | A | A | A | A | A | A |
| | 0.7pF (0R7) | A | A | A | A | A | A | A | A | A |
| | 0.8pF (0R8) | A | A | A | A | A | A | A | A | A |
| | 0.9pF (0R9) | A | A | A | A | A | A | A | A | A |
| | 1.0pF (1R0) | A | A | A | A | A | A | A | A | A |
| | 1.2pF (1R2) | A | A | A | A | A | A | A | A | A |
| | 1.5pF (1R5) | A | A | A | A | A | A | A | A | A |
| | 1.8pF (1R8) | A | A | A | A | A | A | A | A | A |
| | 2.2pF (2R2) | A | A | A | A | A | A | A | A | A |
| | 2.7pF (2R7) | A | A | A | A | A | A | A | A | A |
| | 3.3pF (3R3) | A | A | A | A | A | A | A | A | A |
| | 3.9pF (3R9) | A | A | A | A | A | A | A | A | A |
| | 4.7pF (4R7) | A | A | A | A | A | A | A | A | A |
| | 5.6pF (5R6) | A | A | A | A | A | A | A | A | A |
| | 6.8pF (6R8) | A | A | A | A | A | A | A | A | A |
| | 8.2pF (8R2) | A | A | A | A | A | A | A | A | A |
| | 10pF (100) | A | A | A | A | A | A | A | A | A |
| | 12pF (120) | A | A | A | A | A | A | A | A | A |
| | 15pF (150) | A | A | A | A | A | A | A | A | A |
| | 18pF (180) | A | A | A | A | A | A | A | A | A |
| | 22pF (220) | A | A | A | A | A | A | A | A | A |
| | 27pF (270) | A | A | A | A | A | A | A | A | A |
| | 33pF (330) | A | A | A | A | A | A | A | A | A |
| | 39pF (390) | A | A | A | A | A | A | A | A | A |
| | 47pF (470) | A | A | A | A | A | A | A | A | A |
| | 56pF (560) | A | A | A | A | A | A | A | A | A |
| | 68pF (680) | A | A | A | A | A | A | A | A | A |
| | 82pF (820) | A | A | A | A | A | A | A | B | B |
| | 100pF (101) | A | A | A | A | A | B | B | B | B |
| | 120pF (121) | A | A | A | A | A | B | B | D | D |
| | 150pF (151) | A | A | A | A | A | D | D | D | D |
| | 180pF (181) | A | A | A | A | A | D | D | D | D |
| | 220pF (221) | A | A | A | A | A | D | D | D | D |
| | 270pF (271) | A | A | A | A | A | D | D | D | D |
| | 330pF (331) | A | A | A | A | A | D | D | D | D |
| | 390pF (391) | B | B | B | B | B | D | D | D | D |
| | 470pF (471) | B | B | B | B | B | D | D | D | D |
| | 560pF (561) | B | B | B | B | B | D | D | D | D |
| | 680pF (681) | B | B | B | B | B | D | D | D | D |
| 820pF (821) | B | B | B | B | B | D | D | D | D | |
| 1,000pF (102) | B | B | B | B | B | D | D | D | D | |
| 1,200pF (122) | B | B | B | B | B | D | D | D | D | |
| 1,500pF (152) | B | B | B | B | B | D | D | D | D | |
| 1,800pF (182) | B | B | B | B | B | D | D | D | D | |
| 2,200pF (222) | B | B | B | B | B | D | D | D | D | |
| 2,700pF (272) | D | D | D | D | D | D | D | D | D | |
| 3,300pF (332) | D | D | D | D | D | D | D | D | D | |
| 3,900pF (392) | D | D | D | D | D | D | D | D | D | |
| 4,700pF (472) | D | D | D | D | D | D | D | D | D | |
| 5,600pF (562) | D | D | D | D | D | D | D | D | D | |
| 6,800pF (682) | D | D | D | D | D | D | D | D | D | |
| 8,200pF (822) | D | D | D | D | D | D | D | D | D | |
| 0.01μF (103) | D | D | D | D | D | D | D | D | D | |

Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1206 Size (Continued)

| DIELECTRIC | | NP0 | | | | | | | | | |
|---------------|-------------|------|----|----|----|-----|-----|-----|-----|-----|------|
| SIZE | | 1206 | | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance | 1.0pF (1R0) | | | | | | | | | | |
| | 1.2pF (1R2) | B | B | B | B | B | B | B | B | B | |
| | 1.5pF (1R5) | B | B | B | B | B | B | B | B | B | B |
| | 1.8pF (1R8) | B | B | B | B | B | B | B | B | B | B |
| | 2.2pF (2R2) | B | B | B | B | B | B | B | B | B | B |
| | 2.7pF (2R7) | B | B | B | B | B | B | B | B | B | B |
| | 3.3pF (3R3) | B | B | B | B | B | B | B | B | B | B |
| | 3.9pF (3R9) | B | B | B | B | B | B | B | B | B | B |
| | 4.7pF (4R7) | B | B | B | B | B | B | B | B | B | B |
| | 5.6pF (5R6) | B | B | B | B | B | B | B | B | B | B |
| | 6.8pF (6R8) | B | B | B | B | B | B | B | B | B | B |
| | 8.2pF (8R2) | B | B | B | B | B | B | B | B | B | B |
| | 10pF (100) | B | B | B | B | B | B | B | B | B | B |
| | 12pF (120) | B | B | B | B | B | B | B | B | B | B |
| | 15pF (150) | B | B | B | B | B | B | B | B | B | B |
| | 18pF (180) | B | B | B | B | B | B | B | B | B | B |
| | 22pF (220) | B | B | B | B | B | B | B | B | B | D |
| | 27pF (270) | B | B | B | B | B | B | B | B | B | D |
| | 33pF (330) | B | B | B | B | B | B | B | B | B | D |
| | 39pF (390) | B | B | B | B | B | B | B | B | B | D |
| | 47pF (470) | B | B | B | B | B | B | B | B | B | D |
| | 56pF (560) | B | B | B | B | B | B | B | B | B | D |
| | 68pF (680) | B | B | B | B | B | B | B | B | B | D |
| | 82pF (820) | B | B | B | B | B | B | B | B | B | D |
| | 100pF (101) | B | B | B | B | B | B | B | B | B | D |
| | 120pF (121) | B | B | B | B | B | B | B | B | B | D |
| | 150pF (151) | B | B | B | B | B | B | B | B | B | D |
| | 180pF (181) | B | B | B | B | B | B | B | B | B | D |
| | 220pF (221) | B | B | B | B | B | B | B | B | B | G |
| | 270pF (271) | B | B | B | B | B | B | C | C | C | G |
| | 330pF (331) | B | B | B | B | B | B | C | C | C | G |
| | 390pF (391) | B | B | B | B | B | B | C | C | C | G |
| | 470pF (471) | B | B | B | B | B | B | C | C | C | G |
| | 560pF (561) | B | B | B | B | B | B | C | D | D | G |
| 680pF (681) | B | B | B | B | B | B | C | D | D | G | |
| 820pF (821) | B | B | B | B | B | B | C | G | G | G | |
| 1,000pF (102) | B | B | B | B | B | B | C | G | G | G | |
| 1,200pF (122) | B | B | B | B | B | B | C | G | G | | |
| 1,500pF (152) | B | B | B | B | B | B | D | G | G | | |
| 1,800pF (182) | B | B | B | B | B | B | D | G | G | | |
| 2,200pF (222) | B | B | B | B | B | B | D | G | G | | |
| 2,700pF (272) | B | B | B | B | B | B | D | G | | | |
| 3,300pF (332) | B | B | B | B | B | B | D | G | | | |
| 3,900pF (392) | B | B | B | B | B | B | D | G | | | |
| 4,700pF (472) | B | B | B | B | B | B | D | G | | | |
| 5,600pF (562) | B | B | B | B | B | B | | | | | |
| 6,800pF (682) | C | C | C | C | C | C | | | | | |
| 8,200pF (822) | D | D | D | D | D | D | | | | | |
| 0.01μF (103) | D | D | D | D | D | D | | | | | |

Multilayer Ceramic Capacitors
NP0 Dielectric 1210 Size (Continued)

| DIELECTRIC | | NP0 | | | | | | | | | |
|---------------|---------------|------|----|----|----|-----|-----|-----|-----|-----|------|
| SIZE | | 1210 | | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance | 10pF (100) | C | C | C | C | C | C | C | C | C | C |
| | 12pF (120) | C | C | C | C | C | C | C | C | C | C |
| | 15pF (150) | C | C | C | C | C | C | C | C | C | C |
| | 18pF (180) | C | C | C | C | C | C | C | C | C | C |
| | 22pF (220) | C | C | C | C | C | C | C | C | C | C |
| | 27pF (270) | C | C | C | C | C | C | C | C | C | C |
| | 33pF (330) | C | C | C | C | C | C | C | C | C | C |
| | 39pF (390) | C | C | C | C | C | C | C | C | C | C |
| | 47pF (470) | C | C | C | C | C | C | C | C | C | C |
| | 56pF (560) | C | C | C | C | C | C | C | C | C | C |
| | 68pF (680) | C | C | C | C | C | C | C | C | C | C |
| | 82pF (820) | C | C | C | C | C | C | C | C | C | C |
| | 100pF (101) | C | C | C | C | C | C | C | C | C | D |
| | 120pF (121) | C | C | C | C | C | C | C | C | C | D |
| | 150pF (151) | C | C | C | C | C | C | C | C | C | D |
| | 180pF (181) | C | C | C | C | C | C | C | C | C | D |
| | 220pF (221) | C | C | C | C | C | C | C | C | C | G |
| | 270pF (271) | C | C | C | C | C | C | C | C | C | G |
| | 330pF (331) | C | C | C | C | C | C | C | C | C | G |
| | 390pF (391) | C | C | C | C | C | C | C | C | C | G |
| | 470pF (471) | C | C | C | C | C | C | C | C | C | G |
| | 560pF (561) | C | C | C | C | C | C | C | C | C | G |
| | 680pF (681) | C | C | C | C | C | C | C | C | C | G |
| | 820pF (821) | C | C | C | C | C | C | C | C | C | G |
| | 1,000pF (102) | C | C | C | C | C | D | D | D | D | G |
| | 1,200pF (122) | C | C | C | C | C | D | D | D | D | |
| | 1,500pF (152) | C | C | C | C | C | D | D | D | D | |
| | 1,800pF (182) | C | C | C | C | C | D | D | D | D | |
| | 2,200pF (222) | C | C | C | C | C | D | D | D | D | |
| | 2,700pF (272) | C | C | C | C | C | D | D | D | D | |
| | 3,300pF (332) | C | C | C | C | C | D | D | D | D | |
| | 3,900pF (392) | C | C | C | C | C | D | D | D | D | |
| | 4,700pF (472) | C | C | C | C | C | G | G | | | |
| | 5,600pF (562) | C | C | C | C | C | G | G | | | |
| | 6,800pF (682) | C | C | C | C | C | G | G | | | |
| 8,200pF (822) | C | C | C | C | C | G | G | | | | |
| 0.010μF (103) | C | C | C | C | C | G | G | | | | |
| 0.012μF (123) | D | D | D | D | D | | | | | | |
| 0.015μF (153) | D | D | D | D | D | | | | | | |
| 0.018μF (183) | K | K | K | K | K | | | | | | |
| 0.022μF (223) | K | K | K | K | K | | | | | | |
| 0.027μF (273) | K | K | K | K | K | | | | | | |
| 0.033μF (333) | K | K | K | K | K | | | | | | |
| 0.039μF (393) | K | K | K | K | K | | | | | | |
| 0.047μF (473) | K | K | K | K | K | | | | | | |

Multilayer Ceramic Capacitors
NP0 Dielectric 1812 Size (Continued)

| DIELECTRIC | NP0 | | | | |
|---------------------|------|----|----|----|-----|
| | 1812 | | | | |
| SIZE | 10 | 16 | 25 | 50 | 100 |
| RATED VOLTAGE (VDC) | 10 | 16 | 25 | 50 | 100 |
| 10pF (100) | | | | | D |
| 12pF (120) | | | | | D |
| 15pF (150) | | | | | D |
| 18pF (180) | | | | | D |
| 22pF (220) | | | | | D |
| 27pF (270) | | | | | D |
| 33pF (330) | | | | | D |
| 39pF (390) | | | | | D |
| 47pF (470) | | | | | D |
| 56pF (560) | | | | | D |
| 68pF (680) | | | | | D |
| 82pF (820) | | | | | D |
| 100pF (101) | | | | | D |
| 120pF (121) | | | | | D |
| 150pF (151) | | | | | D |
| 180pF (181) | | | | | D |
| 220pF (221) | | | | | D |
| 270pF (271) | | | | | D |
| 330pF (331) | | | | | D |
| 390pF (391) | | | | | D |
| 470pF (471) | | | | | D |
| 560pF (561) | | | | | D |
| 680pF (681) | | | | | D |
| 820pF (821) | | | | | D |
| 1,000pF (102) | D | D | D | D | D |
| 1,200pF (122) | D | D | D | D | D |
| 1,500pF (152) | D | D | D | D | D |
| 1,800pF (182) | D | D | D | D | D |
| 2,200pF (222) | D | D | D | D | D |
| 2,700pF (272) | D | D | D | D | D |
| 3,300pF (332) | D | D | D | D | D |
| 3,900pF (392) | D | D | D | D | D |
| 4,700pF (472) | D | D | D | D | D |
| 5,600pF (562) | D | D | D | D | D |
| 6,800pF (682) | D | D | D | D | D |
| 8,200pF (822) | D | D | D | D | D |
| 0.010μF (103) | D | D | D | D | D |
| 0.012μF (123) | D | D | D | D | D |
| 0.015μF (153) | D | D | D | D | D |
| 0.018μF (183) | D | D | D | D | D |
| 0.022μF (223) | D | D | D | D | D |
| 0.027μF (273) | D | D | D | D | D |
| 0.033μF (333) | D | D | D | D | D |
| 0.039μF (393) | | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

8. CAPACITANCE RANGE (X7R Dielectric)

X7R Dielectric 0201, 0402, 0603 Sizes

| DIELECTRIC | X7R | | | | | | | | | | | | | |
|--------------|---------------|------|----|----|----|------|----|----|----|------|----|----|----|-----|
| | SIZE | 0201 | | | | 0402 | | | | 0603 | | | | |
| | RATED VOLTAGE | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 100pF (101) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 120pF (121) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 150pF (151) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 180pF (181) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 220pF (221) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 270pF (271) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 330pF (331) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 390pF (391) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 470pF (471) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 560pF (561) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 680pF (681) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 820pF (821) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 1,000pF (102) | L | L | L | L | N | N | N | N | S | S | S | S | S |
| | 1,200pF (122) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 1,500pF (152) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 1,800pF (182) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 2,200pF (222) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 2,700pF (272) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 3,300pF (332) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 3,900pF (392) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 4,700pF (472) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 5,600pF (562) | L | L | L | | N | N | N | N | S | S | S | S | S |
| | 6,800pF (682) | L | | | | N | N | N | N | S | S | S | S | S |
| | 8,200pF (822) | L | | | | N | N | N | N | S | S | S | S | S |
| | 0.010μF (103) | L | | | | N | N | N | N | S | S | S | S | S |
| | 0.012μF (123) | | | | | N | N | N | | S | S | S | S | X |
| | 0.015μF (153) | | | | | N | N | N | | S | S | S | S | X |
| | 0.018μF (183) | | | | | N | N | N | | S | S | S | S | X |
| | 0.022μF (223) | | | | | N | N | N | | S | S | S | S | X |
| | 0.027μF (273) | | | | | N | N | N | | S | S | S | S | |
| | 0.033μF (333) | | | | | N | N | N | | S | S | S | X | |
| | 0.039μF (393) | | | | | N | N | N | | S | S | S | X | |
| | 0.047μF (473) | | | | | N | N | N | | S | S | S | X | |
| | 0.056μF (563) | | | | | N | N | | | S | S | S | X | |
| | 0.068μF (683) | | | | | N | N | | | S | S | S | X | |
| | 0.082μF (823) | | | | | N | N | | | S | S | S | X | |
| | 0.10μF (104) | | | | | N | N | | | S | S | S | X | |
| | 0.12μF (124) | | | | | | | | | S | S | X | | |
| | 0.15μF (154) | | | | | | | | | S | S | X | | |
| | 0.18μF (184) | | | | | | | | | S | S | X | | |
| 0.22μF (224) | | | | | | | | | S | S | X | | | |
| 0.27μF (274) | | | | | | | | | X | X | X | | | |
| 0.33μF (334) | | | | | | | | | X | X | X | | | |
| 0.39μF (394) | | | | | | | | | X | X | X | | | |
| 0.47μF (474) | | | | | | | | | X | X | X | | | |

Multilayer Ceramic Capacitors
X7R Dielectric 0805, 1206 Size

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|------|----|----|----|----|-----|-----|-----|-----|-----|
| SIZE | | 0805 | | | | | | | | 1206 | | | | | | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 |
| Capacitance | 100pF (101) | B | B | B | B | B | B | B | B | B | | | | | | D | D | D | D |
| | 120pF (121) | B | B | B | B | B | B | B | B | B | | | | | | D | D | D | D |
| | 150pF (151) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 180pF (181) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 220pF (221) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 270pF (271) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 330pF (331) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 390pF (391) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 470pF (471) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 560pF (561) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 680pF (681) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 820pF (821) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,000pF (102) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,200pF (122) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,500pF (152) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,800pF (182) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 2,200pF (222) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 2,700pF (272) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 3,300pF (332) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 3,900pF (392) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 4,700pF (472) | B | B | B | B | B | B | B | D | D | B | B | B | B | B | D | D | D | D |
| | 5,600pF (562) | B | B | B | B | B | B | B | D | D | B | B | B | B | B | D | D | D | D |
| | 6,800pF (682) | B | B | B | B | B | B | B | D | D | B | B | B | B | B | D | D | D | D |
| | 8,200pF (822) | B | B | B | B | B | B | B | D | D | B | B | B | B | B | D | D | D | D |
| | 0.010μF (103) | B | B | B | B | B | D | D | D | D | B | B | B | B | B | D | D | D | D |
| | 0.012μF (123) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.015μF (153) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.018μF (183) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.022μF (223) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.027μF (273) | B | B | B | B | D | | | | | B | B | B | B | B | D | D | | |
| | 0.033μF (333) | B | B | B | B | D | | | | | B | B | B | B | B | G | G | | |
| | 0.039μF (393) | B | B | B | B | D | | | | | B | B | B | B | B | G | G | | |
| | 0.047μF (473) | B | B | B | B | D | | | | | B | B | B | B | B | G | G | | |
| | 0.056μF (563) | B | B | B | B | D | | | | | B | B | B | B | B | G | G | | |
| | 0.068μF (683) | B | B | B | B | D | | | | | B | B | B | B | B | G | G | | |
| | 0.082μF (823) | B | B | B | B | D | | | | | B | B | B | B | D | G | G | | |
| | 0.10μF (104) | B | B | B | B | D | | | | | B | B | B | B | D | G | G | | |
| | 0.12μF (124) | B | B | B | D | | | | | | B | B | B | B | D | | | | |
| | 0.15μF (154) | D | D | D | D | | | | | | C | C | C | C | G | | | | |
| | 0.18μF (184) | D | D | D | D | | | | | | C | C | C | C | G | | | | |
| 0.22μF (224) | D | D | D | D | | | | | | C | C | C | C | G | | | | | |
| 0.27μF (274) | D | D | D | | | | | | | C | C | C | D | | | | | | |
| 0.33μF (334) | D | D | D | | | | | | | C | C | C | D | | | | | | |
| 0.39μF (394) | D | D | D | | | | | | | C | C | J | P | | | | | | |
| 0.47μF (474) | D | D | D | | | | | | | J | J | J | P | | | | | | |
| 0.56μF (564) | D | D | D | | | | | | | J | J | J | P | | | | | | |
| 0.68μF (684) | D | D | D | | | | | | | J | J | J | P | | | | | | |
| 0.82μF (824) | D | D | D | | | | | | | J | J | J | P | | | | | | |
| 1.0μF (105) | D | D | D | | | | | | | J | J | J | P | | | | | | |
| 1.5μF (155) | | | | | | | | | | J | J | P | | | | | | | |
| 2.2μF (225) | | | | | | | | | | J | J | P | | | | | | | |
| 4.7μF (475) | | | | | | | | | | | | | | | | | | | |
| 10μF (106) | | | | | | | | | | | | | | | | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors
X7R Dielectric 1210, 1812 Size

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|------|----|----|----|----|-----|-----|-----|
| SIZE | | 1210 | | | | | | | | 1812 | | | | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 1000 | 10 | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance | 100pF (101) | | | | | | | D | D | D | | | | | | | |
| | 120pF (121) | | | | | | | D | D | D | | | | | | | |
| | 150pF (151) | | | | | | | D | D | D | | | | | | | |
| | 180pF (181) | | | | | | | D | D | D | | | | | | | |
| | 220pF (221) | | | | | | | D | D | D | | | | | | | |
| | 270pF (271) | | | | | | | D | D | D | | | | | | | |
| | 330pF (331) | | | | | | | D | D | D | | | | | | | |
| | 390pF (391) | | | | | | | D | D | D | | | | | | | |
| | 470pF (471) | | | | | | | D | D | D | | | | | | | |
| | 560pF (561) | | | | | | | D | D | D | | | | | | | |
| | 680pF (681) | | | | | | | C | D | D | | | | | | | |
| | 820pF (821) | | | | | | | C | D | D | | | | | | | |
| | 1,000pF (102) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 1,200pF (122) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 1,500pF (152) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 1,800pF (182) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 2,200pF (222) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 2,700pF (272) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 3,300pF (332) | C | C | C | C | C | C | C | D | D | D | D | D | D | D | D | D |
| | 3,900pF (392) | C | C | C | C | C | C | C | D | G | D | D | D | D | D | D | D |
| | 4,700pF (472) | C | C | C | C | C | C | C | D | G | D | D | D | D | D | D | D |
| | 5,600pF (562) | C | C | C | C | C | C | C | D | G | D | D | D | D | D | D | D |
| | 6,800pF (682) | C | C | C | C | C | C | C | D | G | D | D | D | D | D | D | D |
| | 8,200pF (822) | C | C | C | C | C | C | C | D | G | D | D | D | D | D | D | D |
| | 0.010μF (103) | C | C | C | C | C | C | C | D | G | D | D | D | D | D | D | D |
| | 0.012μF (123) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| | 0.015μF (153) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| | 0.018μF (183) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| | 0.022μF (223) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| | 0.027μF (273) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| | 0.033μF (333) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| | 0.039μF (393) | C | C | C | C | C | C | C | D | | D | D | D | D | D | D | D |
| 0.047μF (473) | C | C | C | C | C | D | D | | | D | D | D | D | D | D | D | |
| 0.056μF (563) | C | C | C | C | C | D | D | | | D | D | D | D | D | D | D | |
| 0.068μF (683) | C | C | C | C | C | G | G | | | D | D | D | D | D | D | D | |
| 0.082μF (823) | C | C | C | C | C | G | G | | | D | D | D | D | D | D | D | |
| 0.10μF (104) | C | C | C | C | C | G | G | | | D | D | D | D | D | D | D | |
| 0.12μF (124) | C | C | C | C | C | G | G | | | D | D | D | D | D | D | D | |
| 0.15μF (154) | D | D | D | D | D | M | M | | | D | D | D | D | D | K | K | |
| 0.18μF (184) | D | D | D | D | D | M | M | | | D | D | D | D | D | K | K | |
| 0.22μF (224) | D | D | D | D | D | M | M | | | D | D | D | D | D | K | K | |
| 0.27μF (274) | D | D | D | D | G | M | M | | | D | D | D | D | D | K | K | |
| 0.33μF (334) | D | D | D | D | G | M | M | | | D | D | D | D | D | K | K | |
| 0.39μF (394) | D | D | D | D | M | M | M | | | D | D | D | D | D | K | K | |
| 0.47μF (474) | D | D | D | D | M | M | M | | | D | D | D | D | K | K | K | |
| 0.56μF (564) | D | D | D | D | M | | | | | D | D | D | D | K | | | |
| 0.68μF (684) | D | D | D | D | K | | | | | D | D | D | K | K | | | |
| 0.82μF (824) | D | D | D | D | K | | | | | D | D | D | K | K | | | |
| 1.00μF (105) | D | D | D | D | K | | | | | D | D | D | K | K | | | |
| 1.50μF (155) | K | K | G | | | | | | | | | | | | K | | |
| 2.20μF (225) | K | K | G | | | | | | | | | | | | M | | |

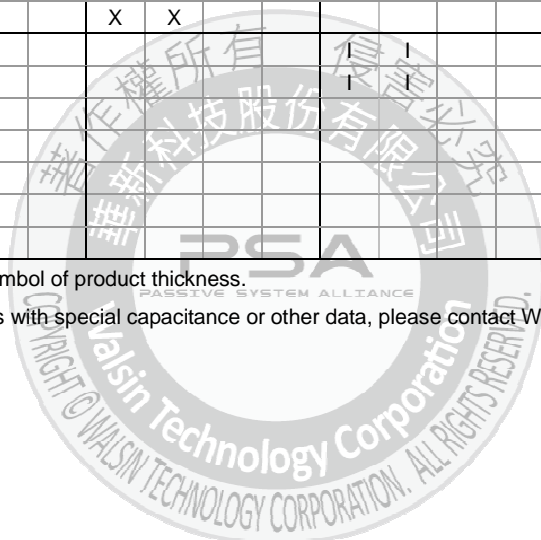
1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

9. CAPACITANCE RANGE (X5R Dielectric)

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

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.



Multilayer Ceramic Capacitors
10. 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 | 15k | 70k | - | - |
| 0402 (1005) | 0.50±0.05 | N | 10k | 50k | - | - |
| 0603 (1608) | 0.80±0.07 | S | 4k | 15k | - | - |
| | 0.80+0.15/-0.10 | X | 4k | 15k | - | - |
| 0805 (2012) | 0.60±0.10 | A | 4k | 15k | - | - |
| | 0.80±0.10 | B | 4k | 15k | - | - |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.25±0.20 | I | - | - | 3k | 10k |
| 1206 (3216) | 0.80±0.10 | B | 4k | 15k | - | - |
| | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.15±0.15 | J | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | 10k |
| | 1.60+0.30/-0.10 | P | - | - | 2k | 9k |
| 1210 (3225) | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | - |
| | 2.00±0.20 | K | - | - | 1k | 6k |
| | 2.50±0.30 | M | - | - | 1k | 6k |
| 1812 (4532) | 1.25±0.10 | D | - | - | 1k | 5k |
| | 2.00±0.20 | K | - | - | 1k | - |
| | 2.50±0.30 | M | - | - | 0.5k | 3k |

Unit: pieces



Multilayer Ceramic Capacitors

11. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--|--|---|--|---------------------|-----------------------|---------------|---|--|--|---|--|---|------------------------------------|---------------|-----------------------|------------------------------|---|--------------------|---|------------------|--|---|---|--|---|------|--|------|---------------|-----|--------|-------|---|---------|--|---------|---------------|-----|--------|------|---|-------|---|-------|--|-----|------|-------|--|-------|--|-------|--------------------------|------|-------|-------|---|-------|--------------|-----|-----|----|-------|-----|-----|
| 1. | Visual and Mechanical | --- | * No remarkable defect. * Dimensions to conform to individual specification sheet. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | Capacitance | Class I: (NP0) ≤ 1000pF, 1.0±0.2Vrms · 1MHz±10% > 1000pF, 1.0±0.2Vrms · 1KHz±10% | * Shall not exceed the limits given in the detailed spec. NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R, X5R, X6S, X7S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | Q/ D.F. (Dissipation Factor) | Class II: (X7R, X7E, X6S, X5R, X7S, Y5V) C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% ** C > 10μF, 0.5±0.2Vrms · 120Hz±20% ** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V, 10V, 16V) ^{#1} , 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V, 10V), TT18X ≥ 475(10V) , TT15X series X6S: 0201/474(4V), 0201 ≥ 104 (6.3V, 10V) ^{#1} , 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V) #1 Excluding X5R/0201/105(6.3V); 225(10V), X6S/0201/104(10V) (1.0±0.2Vrms · 1KHz±10%) *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. | <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 10%</td> <td>0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="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 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <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 rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 0.47μF</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; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; TT series</td> </tr> <tr> <td>≤ 10%</td> <td>0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series</td> </tr> <tr> <td>≤ 15%</td> <td>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | ≥ 100V | ≤ 2.5% | ≤ 3% | 1206 ≥ 0.47μF | ≤ 5% | 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series | ≤ 10% | 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 2.5% | ≤ 3% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF; 1210 ≥ 4.7μF | ≤ 10% | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | 35V | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 7% | 0603 ≥ 0.33μF | 25V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series | ≤ 12.5% | 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% | 0402 ≥ 0.47μF | 16V | ≤ 3.5% | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | ≤ 10% | 0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; TT series | ≤ 10% | 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | 10V | ≤ 5% | ≤ 10% | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series | ≤ 15% | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5 | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 10% | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series | ≤ 20% | 0402 ≥ 2.2μF | --- | --- | 4V | ≤ 15% | --- | --- |
| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 100V | ≤ 2.5% | ≤ 3% | 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% | 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% | 0805 > 0.22μF; 1210 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V | ≤ 2.5% | ≤ 3% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% | 0201 ≥ 0.01μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 7% | 0603 ≥ 0.33μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 12.5% | 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 12.5% | 0402 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤ 3.5% | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% | 0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% | 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 5% | ≤ 10% | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 10% | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% | 0402 ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 15% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4. | Dielectric Strength | To apply voltage (≤100V) 250%. 200V~300V ≥ 2 times VDC 400V~450V ≥ 1.2 times VDC 500V~999V ≥ 1.5 times VDC 1000V~3000V ≥ 1.2 times VDC Duration: 1 to 5 sec. Charge and discharge current less than 50mA. | * No evidence of damage or flash over during test. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 5. | Insulation Resistance | Rated voltage: ≤100V To apply rated voltage for MAX. 120sec. | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <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; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V ; 4V ; TT series; 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="7">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; TT21 > 4.7μF</td> </tr> <tr> <td>6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT15 > 1.0μF</td> </tr> <tr> <td>4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF</td> </tr> </tbody> </table> | Rated voltage | Insulation Resistance | 100V: All X7R | 10GΩ or RxC ≥ 100 Ω-F whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V ; 4V ; TT series; Size ≥ 1812 | Rated voltage | Insulation Resistance | All X6S items, All X7S items | RxC ≥ 50 Ω-F. | 100V: 1210 ≥ 3.3μF | 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF | 35V: 0603 ≥ 1μF; | 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF | 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF | 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT21 > 4.7μF | 6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT15 > 1.0μF | 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: All X7R | 10GΩ or RxC ≥ 100 Ω-F whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V ; 4V ; TT series; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| All X6S items, All X7S items | RxC ≥ 50 Ω-F. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: 1210 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 ≥ 1μF; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT21 > 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT15 > 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Rated voltage: 200~630V | To apply rated voltage (500V max.) for 60 sec. | ≥ 10GΩ or RxC ≥ 1000Ω-F whichever is smaller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Rated voltage: ≥ 630V | To apply 500V for 60 sec. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Multilayer Ceramic Capacitors

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------|----------------------------------|---|---|----------------|-------------|-------------------|----------------------------|-------------------|-----|---------------------|-----|-------------------|----------------------------|-------------------|-----|-------------------|-------|---|------------------|---------------|------------------|----------------------|--|---------------|--|---------------------|------|------|-------------|-------------|---------------|---------------------|--------------------|-----------------|----------------|--|------|-----------|--------------|--------------|----------------|----------------------|----------------|-----------------|--|------|--------------------|-----|------------------|-----|-------------|-----|-------------|-----|-------------|-----|-------------|-----|------------------|
| 6. | Temperature Coefficient | <p>With no electrical load.</p> <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <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> <tr> <td>Y5V</td> <td>-25~ 85°C at 20°C</td> </tr> </tbody> </table> <p>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. * Measurement voltage for Class II:</p> <table border="1"> <thead> <tr> <th>01005</th> <th>0201</th> </tr> </thead> <tbody> <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></td> <td>*0201X104/16V: 0.5V</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</td> <td>1μF<Cap≤4.7μF: 0.5V</td> </tr> <tr> <td>1μF<Cap<10μF: 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</td> <td>10μF<Cap≤100μF: 0.5V</td> </tr> <tr> <td>Cap>10μF: 0.2V</td> <td>Cap>100μF: 0.2V</td> </tr> </tbody> </table> | T.C. | Operating Temp | NPO | -55~125°C at 25°C | X7R | -55~125°C at 25°C | X7S | -55 ~ 125°C at 25°C | X5R | -55~ 85°C at 25°C | X6S | -55~105°C at 25°C | Y5V | -25~ 85°C at 20°C | 01005 | 0201 | Cap≤0.01μF: 0.5V | Cap<0.1μF: 1V | Cap>0.01μF: 0.2V | 0.1μF*≤Cap<1μF: 0.2V | | Cap≥1μF: 0.1V | | *0201X104/16V: 0.5V | 0402 | 0603 | Cap<1μF: 1V | Cap≤1μF: 1V | Cap=1μF: 0.5V | 1μF<Cap≤4.7μF: 0.5V | 1μF<Cap<10μF: 0.2V | Cap>4.7μF: 0.2V | Cap≥10μF: 0.1V | | 0805 | 1206/1210 | Cap<10μF: 1V | Cap≤10μF: 1V | Cap=10μF: 0.5V | 10μF<Cap≤100μF: 0.5V | Cap>10μF: 0.2V | Cap>100μF: 0.2V | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> <tr> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table> | T.C. | Capacitance Change | NPO | Within ±30ppm/°C | X7R | Within ±15% | X7S | Within ±22% | X5R | Within ±15% | X6S | Within ±22% | Y5V | Within +30%/-80% |
| T.C. | Operating Temp | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPO | -55~125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | -55~125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7S | -55 ~ 125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X5R | -55~ 85°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X6S | -55~105°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y5V | -25~ 85°C at 20°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 01005 | 0201 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap≤0.01μF: 0.5V | Cap<0.1μF: 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap>0.01μF: 0.2V | 0.1μF*≤Cap<1μF: 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap≥1μF: 0.1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *0201X104/16V: 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | 0603 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap<1μF: 1V | Cap≤1μF: 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap=1μF: 0.5V | 1μF<Cap≤4.7μF: 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1μF<Cap<10μF: 0.2V | Cap>4.7μF: 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap≥10μF: 0.1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | 1206/1210 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap<10μF: 1V | Cap≤10μF: 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap=10μF: 0.5V | 10μF<Cap≤100μF: 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap>10μF: 0.2V | Cap>100μF: 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T.C. | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPO | Within ±30ppm/°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7S | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X5R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X6S | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y5V | Within +30%/-80% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | Adhesive Strength of Termination | <p>* Pressurizing force : 2N (0201) and 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec.</p> | * No remarkable damage or removal of the terminations. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8. | Vibration Resistance | <p>* Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. *Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p> | <p>* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. | Solderability | <p>* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.</p> | 95% min. coverage of all metalized area. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10. | Bending Test | <p>* 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. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</p> | <p>* No remarkable damage. * Cap change : NPO: within ±5% or 0.5pF whichever is larger X7R; X5R, X6S, X7S: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. | Resistance to Soldering Heat | <p>* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. *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.</p> | <p>* No remarkable damage. * Cap change: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12. | Temperature Cycle | <p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * 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.</p> | Step | Temp. (°C) | Time (min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | <p>* No remarkable damage. * Cap change : NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temp. (°C) | Time (min.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Min. operating temp. +0/-3 | 30±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Max. operating temp. +3/-0 | 30±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Multilayer Ceramic Capacitors

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|---|-----------------------|---|---|--|--|--|--|---|---|------|--|-----------------------------------|---|-----|------|---|--|-----|------|---------------------|---|--|---------------------|-----|------|--|--|-----|--------|---|--|------|-------|--|-----|----|-------|-----|-----|
| 13. | Humidity (Damp Heat) Steady State | *Test temp.: 40±2°C *Humidity: 90~95%RH *Test time: 500+24/-0hrs. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * 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. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V: 0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% * Q/D.F. value: NP0: More than 30pF Q ≥ 350, 10pF ≤ C ≤ 30pF, Q ≥ 275+2.5C Less than 10pF Q ≥ 200+10C X7R, X5R, X6S, X7S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF(0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤ 5%</td> <td>≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 5%</td> <td>≤ 14% 0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series</td> </tr> <tr> <td>≤ 20% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.47μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF);</td> </tr> <tr> <td>≤ 20% 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 15%</td> <td>≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 > 100μF; TT series</td> </tr> <tr> <td>---</td> </tr> <tr> <td rowspan="2">4V</td> <td rowspan="2">≤ 20%</td> <td>---</td> </tr> <tr> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF | ≤ 7.5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series | ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 3% | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF | ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF(0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | 35V | ≤ 5% | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | 25V | ≤ 5% | ≤ 14% 0603 ≥ 0.33μF | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series | ≤ 20% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 20% 0402 ≥ 0.47μF | 16V | ≤ 5% | ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | ≤ 15% 0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series | 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); | ≤ 20% 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 > 100μF; TT series | --- | 4V | ≤ 20% | --- | --- |
| | | | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | ≥ 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | ≤ 7.5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 50V | ≤ 3% | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF(0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 35V | ≤ 5% | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤ 5% | ≤ 14% 0603 ≥ 0.33μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0402 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤ 5% | ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% 0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 > 100μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3μF</td> <td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812</td> </tr> </tbody> </table> | | | Rated voltage | Insulation Resistance | 100V: All X7R; 1210 ≥ 3.3μF | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: All X7R; 1210 ≥ 3.3μF | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Multilayer Ceramic Capacitors

| No | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|--|---|---|--|--|--|--|--|---|---|------|-----------------------------|-----|-----|---|------|-----------------------------|------|---|-----|-----|---|------|--|-----|-----|---|------|--|------|--|------|--|-----|-------|---|------|---|------|------|--|------|--|----|------|-----|
| 14 | Humidity (Damp Heat) Load | *Test temp. : 40±2°C | * No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C≥ 1uF, within ±25% **10V: 0603 ≥4.7µF; 0402 ≥ 1µF; 0201 ≥ 0.1µF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C X7R, X5R, X6S, X7S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | *Humidity : 90~95%RH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | *Test time : 500+24/-0 hrs. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | *To apply voltage : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Rated voltage (MAX. 500V) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | *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. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td>≤6%</td> <td>1206 ≥ 0.47µF</td> </tr> <tr> <td>≤7.5%</td> <td>0805 > 0.1µF; 0603 ≥ 0.068µF; 1206 > 1µF; 1210 ≥ 2.2µF; TT series</td> </tr> <tr> <td>≤20%</td> <td>0805 > 0.22µF; 1210 ≥ 3.3µF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤6%</td> <td>0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF</td> </tr> <tr> <td>≤10%</td> <td>0201 ≥ 0.01µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>≤20%</td> <td>0402 ≥ 0.012µF; 0603 > 0.1µF; 0805 ≥ 1µF(0805/X7R > 0.47µF); 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series</td> </tr> <tr> <td rowspan="2">35V</td> <td>≤5%</td> <td>0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>≤10%</td> <td>0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF</td> </tr> <tr> <td rowspan="4">25V</td> <td>≤5%</td> <td> ≤14% 0603 ≥ 0.33µF 0201 ≥ 0.1µF; 0402 ≥ 0.10µF & (0402/X7R ≥ 0.056µF); TT series 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF ≤20% 0402 ≥ 0.47µF </td> </tr> <tr> <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; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series</td> </tr> <tr> <td>≤15%</td> <td>0201 ≥ 0.012µF; 0402 ≥ 0.33µF(0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF</td> </tr> <tr> <td rowspan="2">10V</td> <td>≤7.5%</td> <td>0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5</td> </tr> <tr> <td>≤20%</td> <td>0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5</td> </tr> <tr> <td rowspan="2">6.3V</td> <td>≤15%</td> <td>0201 ≥ 0.1µF; 0402 ≥ 1µF(0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series</td> </tr> <tr> <td>≤30%</td> <td>0201 ≥ 0.1µF; 0402 ≥ 1µF(0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥100V | ≤6% | 1206 ≥ 0.47µF | ≤7.5% | 0805 > 0.1µF; 0603 ≥ 0.068µF; 1206 > 1µF; 1210 ≥ 2.2µF; TT series | ≤20% | 0805 > 0.22µF; 1210 ≥ 3.3µF | 50V | ≤6% | 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF | ≤10% | 0201 ≥ 0.01µF; 1210 ≥ 4.7µF | ≤20% | 0402 ≥ 0.012µF; 0603 > 0.1µF; 0805 ≥ 1µF(0805/X7R > 0.47µF); 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series | 35V | ≤5% | 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF | ≤10% | 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF | 25V | ≤5% | ≤14% 0603 ≥ 0.33µF 0201 ≥ 0.1µF; 0402 ≥ 0.10µF & (0402/X7R ≥ 0.056µF); TT series 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF ≤20% 0402 ≥ 0.47µF | ≤10% | 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF | ≤15% | 0201 ≥ 0.01µF(0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series | ≤15% | 0201 ≥ 0.012µF; 0402 ≥ 0.33µF(0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF | 10V | ≤7.5% | 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | ≤20% | 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | 6.3V | ≤15% | 0201 ≥ 0.1µF; 0402 ≥ 1µF(0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series | ≤30% | 0201 ≥ 0.1µF; 0402 ≥ 1µF(0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series | 4V | ≤20% | --- |
| | | Rated vol. | | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥100V | | ≤6% | 1206 ≥ 0.47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤7.5% | 0805 > 0.1µF; 0603 ≥ 0.068µF; 1206 > 1µF; 1210 ≥ 2.2µF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤20% | 0805 > 0.22µF; 1210 ≥ 3.3µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | | ≤6% | 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤10% | 0201 ≥ 0.01µF; 1210 ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤20% | 0402 ≥ 0.012µF; 0603 > 0.1µF; 0805 ≥ 1µF(0805/X7R > 0.47µF); 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | ≤5% | 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ≤10% | 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤5% | ≤14% 0603 ≥ 0.33µF 0201 ≥ 0.1µF; 0402 ≥ 0.10µF & (0402/X7R ≥ 0.056µF); TT series 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF ≤20% 0402 ≥ 0.47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ≤10% | 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ≤15% | 0201 ≥ 0.01µF(0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ≤15% | 0201 ≥ 0.012µF; 0402 ≥ 0.33µF(0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤7.5% | 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ≤20% | 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤15% | 0201 ≥ 0.1µF; 0402 ≥ 1µF(0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ≤30% | 0201 ≥ 0.1µF; 0402 ≥ 1µF(0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | *I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3µF</td> <td rowspan="7">500MΩ or RxC ≥ 5 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 > 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF</td> </tr> <tr> <td>6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812</td> </tr> </tbody> </table> | Rated voltage | Insulation Resistance | 100V: All X7R; 1210 ≥ 3.3µF | 500MΩ or RxC ≥ 5 Ω-F whichever is smaller. | 50V: 0402 > 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF | 35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF | 25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF | 16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF | 6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: All X7R; 1210 ≥ 3.3µF | 500MΩ or RxC ≥ 5 Ω-F whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 > 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

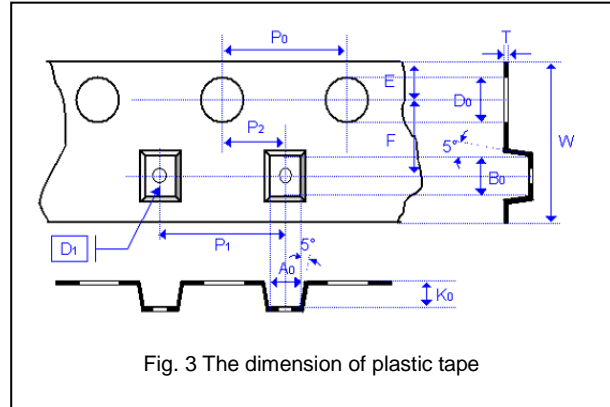
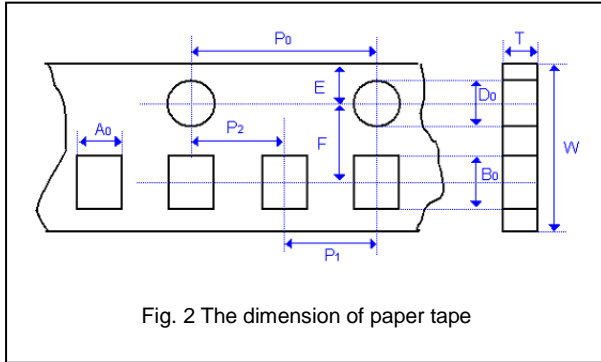
Multilayer Ceramic Capacitors

| No | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--|---|-----------------------|-----------------------------|---|--|---|---|---|--|---|-------------|---|-----------------|-----------|--|-----------------|------------|--|-----------|------------|---|------|-------------|---|-----------|-----------------|-----------|----------|------|-----------------|-----------|-----------|------|-----------------|----------|-----------|------|-------------|-----------|----------|------------|----------|-----------------|----------|-----------|-------------|-----------|----------|--------|-----------|------|-----------|------|-----------------|------|-----------|-----------|-----------|------|-------------|----------------------|----------|----------|-----------|-----------|-----------|------|----------|
| 15. | High Temperature Load (Endurance) | Test temp. : NP0, X7R/X7E/X7S: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) ≤ 6.3V or C ≥ 10µF: 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range. | * No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; TT series & C ≥ 1µF, within ±25%; **10V: 0603 ≥ 4.7µF; 0402 ≥ 1µF; 0201 ≥ 0.1µF, within ±25%; Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q≥350 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C X7R, X5R, X6S, X7S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X6S</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 rowspan="2">0603</td> <td rowspan="2">X7R/X7S/Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>X5R/X7R/X6S/X7S</td> <td>4V</td> <td>C ≥ 22µF</td> </tr> <tr> <td rowspan="3">0805</td> <td rowspan="3">X5R/X7R/X6S/X7S</td> <td>6.3V, 10V</td> <td>C ≥ 4.7µF</td> </tr> <tr> <td>25V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>35V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td rowspan="3">1206</td> <td rowspan="3">X5R/X7R/X6S</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">1210</td> <td rowspan="2">X5R/X7R/X6S</td> <td>16V, 25V</td> <td>C ≥ 10µF</td> </tr> <tr> <td>X5R</td> <td>C ≥ 22µF</td> </tr> <tr> <td>TT15</td> <td>X5R</td> <td>6.3V</td> <td>C > 1.0µF</td> </tr> <tr> <td>TT18</td> <td>Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 2.2µF</td> </tr> <tr> <td rowspan="2">TT21</td> <td rowspan="2">X5R/X7R/X6S</td> <td>6.3V</td> <td>C ≥ 10µF</td> </tr> <tr> <td>≤ 10V</td> <td>C ≥ 10µF</td> </tr> <tr> <td>TT31</td> <td>Y5V</td> <td>6.3V</td> <td>C ≥ 22µF</td> </tr> </tbody> </table> | Size | Dielectric | Rated voltage | Capacitance | 0201 | X5R/X7R/X6S | ≤ 10V | C ≥ 0.1µF | ≥ 16V | C > 0.1µF | 0402 | X5R | ≤ 16V | C > 1.0µF | 25V, 50V | C ≥ 1.0µF | X6S | 6.3V, 10V | C > 1.0µF | 16V, 25V | C ≥ 1.0µF | 0603 | X7R/X7S/Y5V | 6.3V, 10V | C ≥ 1.0µF | X5R/X7R/X6S/X7S | 4V | C ≥ 22µF | 0805 | X5R/X7R/X6S/X7S | 6.3V, 10V | C ≥ 4.7µF | 25V | C ≥ 1.0µF | 35V | C ≥ 1.0µF | 1206 | X5R/X7R/X6S | 4V | C ≥ 47µF | 6.3V | C ≥ 22µF | 10V, 50V | C ≥ 10µF | 1210 | X5R/X7R/X6S | 16V, 25V | C ≥ 10µF | X5R | C ≥ 22µF | TT15 | X5R | 6.3V | C > 1.0µF | TT18 | Y5V | 6.3V, 10V | C ≥ 2.2µF | TT21 | X5R/X7R/X6S | 6.3V | C ≥ 10µF | ≤ 10V | C ≥ 10µF | TT31 | Y5V | 6.3V | C ≥ 22µF |
| | | Size | Dielectric | Rated voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0201 | X5R/X7R/X6S | ≤ 10V | C ≥ 0.1µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≥ 16V | C > 0.1µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0402 | X5R | ≤ 16V | C > 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 25V, 50V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | X6S | 6.3V, 10V | C > 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 16V, 25V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0603 | X7R/X7S/Y5V | 6.3V, 10V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | X5R/X7R/X6S/X7S | 4V | C ≥ 22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0805 | X5R/X7R/X6S/X7S | 6.3V, 10V | C ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 25V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 35V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1206 | X5R/X7R/X6S | 4V | C ≥ 47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 6.3V | C ≥ 22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 10V, 50V | C ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1210 | X5R/X7R/X6S | 16V, 25V | C ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | X5R | C ≥ 22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT15 | X5R | 6.3V | C > 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT18 | Y5V | 6.3V, 10V | C ≥ 2.2µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT21 | X5R/X7R/X6S | 6.3V | C ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤ 10V | C ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT31 | Y5V | 6.3V | C ≥ 22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | **1WV items must follow de-rating conditions. (6) 150% of rated voltage for below range. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X6S</td> <td>16V, 25V</td> <td>C=0.1µF</td> </tr> <tr> <td>X7R</td> <td>16V</td> <td>C ≥ 0.022µF</td> </tr> <tr> <td rowspan="3">0402</td> <td rowspan="2">X7R/X5R/X6S</td> <td>50V</td> <td>C > 0.01µF</td> </tr> <tr> <td>10-25V</td> <td>C ≥ 0.22µF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 0.47µF</td> </tr> <tr> <td rowspan="4">0603</td> <td rowspan="2">X7S</td> <td>50V-100V</td> <td>C > 0.22µF</td> </tr> <tr> <td>X7R</td> <td>50V</td> <td>C > 0.1µF</td> </tr> <tr> <td rowspan="2">X5R</td> <td>25V</td> <td>C = 1.0µF</td> </tr> <tr> <td>50V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td rowspan="3">0805</td> <td rowspan="3">X5R/X7R/X6S/X7S</td> <td>10V, 16V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 2.2µF</td> </tr> <tr> <td>100V</td> <td>C ≥ 0.47µF</td> </tr> <tr> <td rowspan="4">1206</td> <td rowspan="2">X5R/X7R/X6S/X7S</td> <td>50V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>35V</td> <td>C ≥ 2.2µF</td> </tr> <tr> <td rowspan="2">Y5V</td> <td>10-25V</td> <td>C ≥ 4.7µF</td> </tr> <tr> <td>16V</td> <td>C ≥ 4.7µF</td> </tr> <tr> <td rowspan="3">1210</td> <td rowspan="3">X5R/X7R/X6S/X7S</td> <td>100V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>50V</td> <td>C = 4.7µF</td> </tr> <tr> <td>100V</td> <td>C > 1.0µF</td> </tr> <tr> <td rowspan="2">1825 2220 2225</td> <td rowspan="2">X7R</td> <td>50V-100V</td> <td>C ≥ 2.2µF</td> </tr> <tr> <td>100V-250V</td> <td>C ≥ 1.0µF</td> </tr> </tbody> </table> | | | Size | Dielectric | Rated voltage | Capacitance | 0201 | X5R/X6S | 16V, 25V | C=0.1µF | X7R | 16V | C ≥ 0.022µF | 0402 | X7R/X5R/X6S | 50V | C > 0.01µF | 10-25V | C ≥ 0.22µF | Y5V | 16V | C ≥ 0.47µF | 0603 | X7S | 50V-100V | C > 0.22µF | X7R | 50V | C > 0.1µF | X5R | 25V | C = 1.0µF | 50V | C ≥ 1.0µF | 0805 | X5R/X7R/X6S/X7S | 10V, 16V | C ≥ 1.0µF | Y5V | 16V | C ≥ 2.2µF | 100V | C ≥ 0.47µF | 1206 | X5R/X7R/X6S/X7S | 50V | C ≥ 1.0µF | 35V | C ≥ 2.2µF | Y5V | 10-25V | C ≥ 4.7µF | 16V | C ≥ 4.7µF | 1210 | X5R/X7R/X6S/X7S | 100V | C ≥ 1.0µF | 50V | C = 4.7µF | 100V | C > 1.0µF | 1825 2220 2225 | X7R | 50V-100V | C ≥ 2.2µF | 100V-250V | C ≥ 1.0µF | | |
| Size | Dielectric | Rated voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0201 | X5R/X6S | 16V, 25V | C=0.1µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | X7R | 16V | C ≥ 0.022µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | X7R/X5R/X6S | 50V | C > 0.01µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10-25V | C ≥ 0.22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Y5V | 16V | C ≥ 0.47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | X7S | 50V-100V | C > 0.22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | X7R | 50V | C > 0.1µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | X5R | 25V | C = 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X5R/X7R/X6S/X7S | 10V, 16V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Y5V | 16V | C ≥ 2.2µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | C ≥ 0.47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206 | X5R/X7R/X6S/X7S | 50V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 35V | C ≥ 2.2µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Y5V | 10-25V | C ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 16V | C ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1210 | X5R/X7R/X6S/X7S | 100V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C = 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | C > 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1825 2220 2225 | X7R | 50V-100V | C ≥ 2.2µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V-250V | C ≥ 1.0µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 35V | ≤ 5% | ≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF ≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF ≤ 14% 0603 ≥ 0.33µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF (0402/X7R ≥ 0.22µF); 0603 > 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF ≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF (0402/X6S ≥ 0.47µF); 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 4.7µF; 1210 ≥ 100µF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y5V: ≥ 50V | ≤ 7.5% | ≤ 10% 0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF ≤ 20% 1210 ≥ 6.8µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | ≤ 10% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤ 7.5% | ≤ 10% 0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF ≤ 15% 0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C < 1.0µF) | ≤ 10% | ≤ 12.5% 0402 ≥ 0.068µF; 0603 ≥ 0.68µF ≤ 20% 0402 ≥ 0.22µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C ≥ 1.0µF) | ≤ 12.5% | ≤ 20% 0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 20% | ≤ 30% 0402 ≥ 0.47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 30% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: All X7R; 1210 ≥ 3.3µF | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 > 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * 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. * De-rating conditions: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

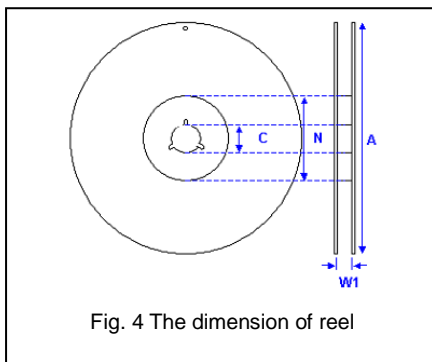
Multilayer Ceramic Capacitors

APPENDIXES

■ **Tape & reel dimensions**



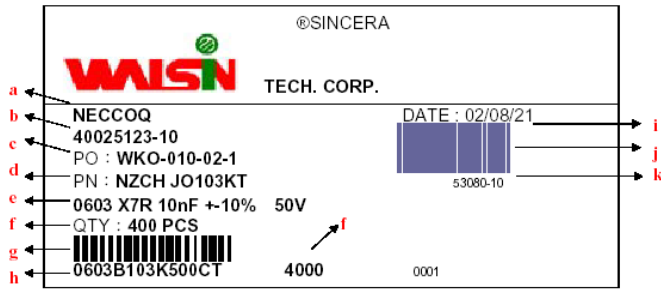
| Size | 0201 | 0402 | 0603 | 0805 | | | 1206 | | | 1210 | | | 1808 | 1812 | |
|-------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 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 |
| A₀ | 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 |
| B₀ | 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 |
| K₀ | - | - | - | - | - | < 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 |
| P₀ | 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 |
| 10xP₀ | 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 |
| P₁ | 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 |
| P₂ | 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 |
| D₀ | 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 |
| D₁ | - | - | - | - | - | 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 |



| Size | 0201, 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 |
| W₁ | 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 |

Multilayer Ceramic Capacitors

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 |
|-----|------------------|--------------------------|--------------------------|
| 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 (Matt) |

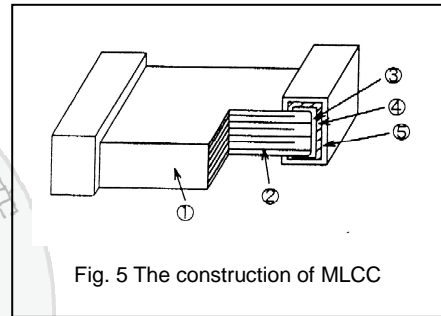


Fig. 5 The construction of MLCC

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.

Multilayer Ceramic Capacitors

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 N₂ within oven are recommended.

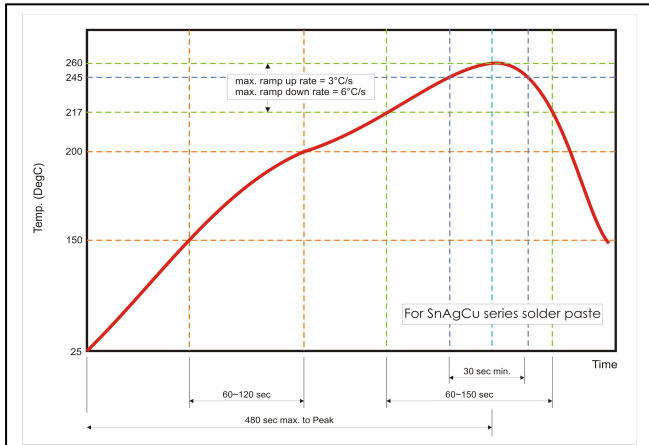


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

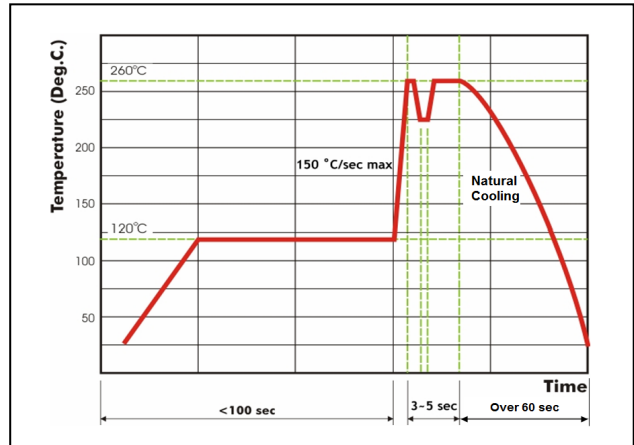


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.

