

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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

2. FEATURES

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

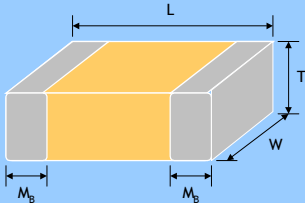
3. APPLICATIONS

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

4. HOW TO ORDER

| <u>1206</u> | <u>B</u> | <u>104</u> | <u>K</u> | <u>500</u> | <u>C</u> | <u>I</u> |
|---|--|---|---|---|--------------------|---|
| <u>Size</u> | <u>Dielectric</u> | <u>Capacitance</u> | <u>Tolerance</u> | <u>Rated voltage</u> | <u>Termination</u> | <u>Packaging style</u> |
| Inch (mm) 0201 (0603) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1812 (4532) | N =NP0 (COG) B =X7R X =X5R S =X6S A =X7S | 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 | A =±0.05pF B =±0.1pF C =±0.25pF D =±0.5pF F =±1% G =±2% J =±5% K =±10% M =±20% Z =-20/+80% | Two significant digits followed by no. of zeros. And R is in place of decimal point. 4R0 =4 VDC 6R3 =6.3 VDC 100 =10 VDC 160 =16 VDC 250 =25 VDC 500 =50 VDC 101 =100 VDC | C =Cu/Ni/Sn | T =7" reeled G =13" reeled |

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} | | | |
| | | 0.6±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} | 0.8±0.20 ^{#1} | 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 | | |
| 3.20+0.30/-0.1 3.30+0.30/-0.1 ^{#5} | 1.60+0.30/-0.10 | 1.60+0.30/-0.10 | P | R | | | |
| 1210 (3225) | 3.20±0.30 | 2.50±0.20 | 0.95±0.10 | C | R | 0.75±0.25 | |
| | | | 0.85±0.10 | T | R | | |
| | | | 1.25±0.10 | D | R | | |
| | 1.60±0.20 | G | R | | | | |
| | 3.20±0.40 | 2.50±0.30 | 2.00±0.20 | K | R | | |
| | 3.20±0.60 ^{#4} | 2.50±0.50 ^{#4} | 2.50±0.50 ^{#4} | M | R | | |
| 1808 (4520) | 4.50±0.40 (4.5+0.5/-0.3) ^{**} | 2.03±0.25 | 1.25±0.10 | D | R | 0.75±0.25 (0.5±0.25) ^{***} | |
| | | | 1.40±0.15 | F | R | | |
| | 1.60±0.20 | G | R | | | | |
| | 2.00±0.20 | K | R | | | | |
| 1812 (4532) | 4.50±0.40 (4.5+0.5/-0.3) ^{**} | 3.20±0.30 | 1.25±0.10 | D | R | 0.75±0.25 (0.5±0.25) ^{***} | |
| | | | 1.60±0.20 | G | R | | |
| | 2.00±0.20 | K | R | | | | |
| | 3.20±0.40 | 2.50±0.30 | 2.50±0.30 | M | R | | |
| | | | 2.80±0.30 | U | R | | |

* R = Reflow soldering process ; W = Wave soldering process.

** For 1808/1812/1825_200V~4000V and safety certificated products.

*** For 1206_≥1000V, 1808/1812_200V~4000V and safety certificated products.

#1: For 0603/Cap ≥ 10μF or 0603(≤ 6.3V)/Cap ≥ 4.7μF or 0603(>10V)/Cap > 1μF products,

Excluding 0603X225(16V&25V), 0603S225(6.3V&16V), 0603X475(6.3V&16V), 0603S475(4V&6.3V).

#2: For 0201/ 0.1uF < Cap < 0.68uF products, Excluding 0201X334~474(≤ 6.3V) & 0201X224(≤ 10V).

#3: For 0201/Cap ≥ 0.68μF products.

#4: For 1210(200V&250V)/Cap > 0.47μF products.

#5: For 1206(100V)/Cap ≥ 1.2μF products.

Multilayer Ceramic Capacitors

6. GENERAL ELECTRICAL DATA

| | | | | | |
|-----------------------------------|---|-----------------------------------|-----------------------|-----------------------|-----------------------|
| Dielectric | NP0 | X7R | X5R | X6S | X7S |
| Size | 0201, 0402, 0603, 0805, 1206, 1210, 1812 | | | | |
| Capacitance range* | 0.1pF to 0.1μF | 100pF to 47μF | 100pF to 220μF | 0.1μF to 100μF | 0.1μF to 100μF |
| Capacitance tolerance** | Cap≤5pF ^{#1} : A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%) | J (±5%), K (±10%), M (±20%) | K (±10%), M (±20%) | K (±10%), M (±20%) | K (±10%), M (±20%) |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V, 100V | 6.3V, 10V, 16V, 25V, 50V, 100V | | | |
| Operating temperature | -55 to +125°C | | -55 to +85°C | -55 to +105°C | -55 to +125°C |
| Capacitance characteristic | ±30ppm | ±15% | ±15% | ±22% | ±22% |
| Termination | Ni/Sn (lead-free termination) | | | | |

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

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

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

X7R/X6S/X5R/X7S: Please refer to page 13 "Reliability test conditions and requirements" for detail.

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



Multilayer Ceramic Capacitors

7. CAPACITANCE RANGE

7-1. NPO Dielectric 0201, 0402, 0603, 0805 Sizes

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

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

Multilayer Ceramic Capacitors

Approval Sheet

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

| DIELECTRIC | NP0 | | | | | | | | | | | | | |
|---------------------|------|------|----|----|-----|----|------|----|----|-----|----|------|----|-----|
| | SIZE | 1206 | | | | | 1210 | | | | | 1812 | | |
| RATED VOLTAGE (VDC) | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 16 | 25 | 50 | 100 |
| 1.0pF (1R0) | | | | | | | | | | | | | | |
| 1.2pF (1R2) | B | B | B | B | B | | | | | | | | | |
| 1.5pF (1R5) | B | B | B | B | B | | | | | | | | | |
| 1.8pF (1R8) | B | B | B | B | B | | | | | | | | | |
| 2.2pF (2R2) | B | B | B | B | B | | | | | | | | | |
| 2.7pF (2R7) | B | B | B | B | B | | | | | | | | | |
| 3.3pF (3R3) | B | B | B | B | B | | | | | | | | | |
| 3.9pF (3R9) | B | B | B | B | B | | | | | | | | | |
| 4.7pF (4R7) | B | B | B | B | B | | | | | | | | | |
| 5.6pF (5R6) | B | B | B | B | B | | | | | | | | | |
| 6.8pF (6R8) | B | B | B | B | B | | | | | | | | | |
| 8.2pF (8R2) | B | B | B | B | B | | | | | | | | | |
| 10pF (100) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 12pF (120) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 15pF (150) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 18pF (180) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 22pF (220) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 27pF (270) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 33pF (330) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 39pF (390) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 47pF (470) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 56pF (560) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 68pF (680) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 82pF (820) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 100pF (101) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 120pF (121) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 150pF (151) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 180pF (181) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 220pF (221) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 270pF (271) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 330pF (331) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 390pF (391) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 470pF (471) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 560pF (561) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 680pF (681) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 820pF (821) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 1,000pF (102) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 1,200pF (122) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 1,500pF (152) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 1,800pF (182) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 2,200pF (222) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 2,700pF (272) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 3,300pF (332) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 3,900pF (392) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 4,700pF (472) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 5,600pF (562) | B | B | B | B | B | C | C | C | C | C | D | D | D | D |
| 6,800pF (682) | C | C | C | C | C | C | C | C | C | C | D | D | D | D |
| 8,200pF (822) | D | D | D | D | D | C | C | C | C | C | D | D | D | D |
| 0.010μF (103) | D | D | D | D | D | C | C | C | C | C | D | D | D | D |
| 0.012μF (123) | P | P | P | P | P | D | D | D | D | D | D | D | D | D |
| 0.015μF (153) | P | P | P | P | P | D | D | D | D | D | D | D | D | D |
| 0.018μF (183) | P | P | P | P | P | K | K | K | K | K | D | D | D | D |
| 0.022μF (223) | P | P | P | P | P | K | K | K | K | K | D | D | D | D |
| 0.027μF (273) | P | P | P | P | P | K | K | K | K | K | D | D | D | D |
| 0.033μF (333) | P | P | P | P | T | K | K | K | K | K | D | D | D | D |
| 0.039μF (393) | P | P | P | P | | K | K | K | K | K | M | M | M | M |
| 0.047μF (473) | P | P | P | P | | K | K | K | K | K | M | M | M | M |
| 0.056μF (563) | P | P | P | P | | | | | | | M | M | M | M |
| 0.068μF (683) | P | P | P | P | | | | | | | M | M | M | M |
| 0.082μF (823) | P | P | P | P | | | | | | | M | M | M | M |
| 0.1μF (104) | P | P | P | P | | | | | | | M | M | M | M |

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

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

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

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

Multilayer Ceramic Capacitors

Approval Sheet

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

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

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

Multilayer Ceramic Capacitors

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

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

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

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

Multilayer Ceramic Capacitors

7-4. X6S Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

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

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

7-5. X7S Dielectric 0402, 0603, 0805, 1206, 1210 Sizes

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

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

8. PACKAGING STYLE AND QUANTITY

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

Unit: pieces

Multilayer Ceramic Capacitors

9. 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 | *Test temp.: Room Temperature. *Class I: (NP0) ≤ 1000pF, 1.0±0.2Vrms · 1MHz±10% > 1000pF, 1.0±0.2Vrms · 1KHz±10% Class II: (X7R, X7E, X6S, X5R, X7S) C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% ** C > 10μF, 0.5±0.2Vrms · 120Hz±20% | * Shall not exceed the limits given in the detailed spec. NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R: <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">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;</td> </tr> <tr> <td>≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5% 0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 15% ---</td> </tr> <tr> <td>---</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤ 15%</td> <td>---</td> </tr> <tr> <td>---</td> </tr> <tr> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 2.5% | ≤ 3% 1206 ≥ 0.47μF | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; | ≤ 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 ≥ 3.3μF | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 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 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% 0402 ≥ 0.47μF | ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF | ≤ 5% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | 10V | ≤ 5% | ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | 6.3V | ≤ 10% | ≤ 20% 0402 ≥ 2.2μF | ≤ 15% --- | --- | 4V | ≤ 15% | --- | --- | --- |
| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 100V | ≤ 2.5% | ≤ 3% 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 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 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 12.5% 0402 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤ 3.5% | ≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 5% | ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 10% | ≤ 20% 0402 ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 15% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | Q/ D.F. (Dissipation Factor) | ** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V, 10V, 16V) #1, 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V) TT18X ≥ 475(10V) , TT15X series X6S: 0201/474(4V), 0201 > 104 (6.3V, 10V), 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) , 0402X475M6R3 (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. | X5R: <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">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5% 0201 = 0.01μF; 0805 ≥ 1μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 > 0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 12.5% 0402 ≥ 0.47μF; 0805 = 10μF</td> </tr> <tr> <td>≤ 5% 0201 = 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 > 0.01μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5% 0402 ≥ 1μF; 0805 = 10μF</td> </tr> <tr> <td>≤ 5% 0201 = 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5% 0805 = 10μF</td> </tr> <tr> <td>≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 15% ---</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤ 15%</td> <td>---</td> </tr> <tr> <td>---</td> </tr> <tr> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 2.5% | ≤ 3% 1206 ≥ 0.47μF | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 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 ≥ 3.3μF | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 3.5% | ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5% 0201 = 0.01μF; 0805 ≥ 1μF | ≤ 7% 0603 ≥ 0.33μF | 25V | ≤ 3.5% | ≤ 10% 0201 > 0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF | ≤ 12.5% 0402 ≥ 0.47μF; 0805 = 10μF | ≤ 5% 0201 = 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% 0201 > 0.01μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% 0402 ≥ 1μF; 0805 = 10μF | ≤ 5% 0201 = 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R | 10V | ≤ 5% | ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 12.5% 0805 = 10μF | ≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF | 6.3V | ≤ 10% | ≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 20% 0402 ≥ 2.2μF | ≤ 15% --- | 4V | ≤ 15% | --- | --- | --- |
| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 100V | ≤ 2.5% | ≤ 3% 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 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 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 35V | ≤ 3.5% | ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% 0201 = 0.01μF; 0805 ≥ 1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 7% 0603 ≥ 0.33μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤ 3.5% | ≤ 10% 0201 > 0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 12.5% 0402 ≥ 0.47μF; 0805 = 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 5% 0201 = 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤ 3.5% | ≤ 10% 0201 > 0.01μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 10V | ≤ 5% | ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 12.5% 0805 = 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 10% | ≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0402 ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 15% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

Multilayer Ceramic Capacitors

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------|--|---|---|--------------|--------------------------|--|------|------------|-------------|--------------------------|------------|-------------|--------------------------|------------|-----------------------|--------------|------------|--|--|-------------|--|--|-------------|---|------------|---|--------------|------------|---|--|-------------|--|--|-------------|--|-------------|--|--------------|-------------|--|------------|--|--------------|------------|--|--|-------------|--|--|-------------|--|---------------|---|--------------|---------------|--|--|-------------|--|--|-------------|---|---------------|--|------------|---------------|---|--|-------------|--|--|-------------|--|-------------|--|-------------|-------------|---|-----|----------------------|-------------|---|----------------------|--|--|------|--|--|--|------------|-------------|--------------------------|--|-------------|--------------|------------|-----------------------|--|------------|--|--|-------------|---|--|-----|--------------|------------|---|--|------------|--|--|-------------|--|--|-----|--------------|-------------|--|--|-----|--------------|------------|--|--|------------|-----------------------|--|-------------|--|--|-----|--------------|---------------|-----------------------|--|------------|--|--|-------------|---|--|-----|------------|---------------|--|--|-------------|---|--|-------------|--|--|------|-------------|-------------|---|--|----|-------------|-----|----------------------|--|--|--|--|--|
| 4. | Dielectric Strength | * To apply voltage ($\leq 100V$) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA. | <table border="1"> <thead> <tr> <th colspan="4">X6S:</th> </tr> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td rowspan="3">$\geq 100V$</td> <td rowspan="3">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td colspan="2">1206 $\geq 0.47\mu F$</td> </tr> <tr> <td>$\leq 5\%$</td> <td colspan="2">0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td colspan="2">0201(50V); 0603 $\geq 0.047\mu F$; 0805 $\geq 0.18\mu F$; 1206 $\geq 0.47\mu F$</td> </tr> <tr> <td>$\leq 5\%$</td> <td colspan="2">0201 $\geq 0.01\mu F$; 1210 $\geq 3.3\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0402 $\geq 0.012\mu F$; 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0402 $\geq 0.22\mu F$; 0603 $\geq 0.33\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 22\mu F$ | | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.47\mu F$; 0603 $\geq 10\mu F$; 0805 $\geq 4.7\mu F$; 1206 $\geq 47\mu F$; 1210 $\geq 100\mu F$ | | 4V | $\leq 15\%$ | --- | 0402 $\geq 2.2\mu F$ | | <table border="1"> <thead> <tr> <th colspan="4">X7S:</th> </tr> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td rowspan="3">$\geq 100V$</td> <td rowspan="3">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td colspan="2">1206 $\geq 0.47\mu F$</td> </tr> <tr> <td>$\leq 5\%$</td> <td colspan="2">0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td colspan="2">0201(50V); 0603 $\geq 0.047\mu F$; 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| | | | X6S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Rated vol. | D.F. \leq | Exception of D.F. \leq | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\geq 100V$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 5\%$ | 0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 10\%$ | 0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu F$; 0805 $\geq 0.18\mu F$; 1206 $\geq 0.47\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 1210 $\geq 3.3\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 10\%$ | 0402 $\geq 0.012\mu F$; 0603 $> 0.1\mu F$; 0805 $\geq 1\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 0805 $\geq 1\mu F$; 1210 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 7\%$ | 0603 $\geq 0.33\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 10\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.10\mu F$; 0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 16V | $\leq 3.5\%$ | $\leq 12.5\%$ | 0402 $\geq 0.47\mu F$; 0805 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 0402 $\geq 0.033\mu F$; 0603 $\geq 0.15\mu F$; 0805 $\geq 0.68\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 4.7\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 10\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.22\mu F$; 0603 $> 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 10V | $\leq 5\%$ | $\leq 12.5\%$ | 0402 $\geq 1\mu F$; 0805 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 10\%$ | 0201 $\geq 0.012\mu F$; 0402 $\geq 0.22\mu F$; 0603 $\geq 0.33\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 22\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.47\mu F$; 0603 $\geq 10\mu F$; 0805 $\geq 4.7\mu F$; 1206 $\geq 47\mu F$; 1210 $\geq 100\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 4V | $\leq 15\%$ | --- | 0402 $\geq 2.2\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th colspan="4">X7S:</th> </tr> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td rowspan="3">$\geq 100V$</td> <td rowspan="3">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td colspan="2">1206 $\geq 0.47\mu F$</td> </tr> <tr> <td>$\leq 5\%$</td> <td colspan="2">0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td colspan="2">0201(50V); 0603 $\geq 0.047\mu F$; 0805 $\geq 0.18\mu F$; 1206 $\geq 0.47\mu F$</td> </tr> <tr> <td>$\leq 5\%$</td> <td colspan="2">0201 $\geq 0.01\mu F$; 1210 $\geq 3.3\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0402 $\geq 0.012\mu F$; 0603 $> 0.1\mu F$; 0805 $\geq 1\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$</td> </tr> <tr> <td>35V</td> <td>$\leq 3.5\%$</td> <td>$\leq 10\%$</td> <td colspan="2">0603 $\geq 1\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">$\leq 3.5\%$</td> <td>$\leq 5\%$</td> <td colspan="2">0201 $\geq 0.01\mu F$; 0805 $\geq 1\mu F$; 1210 $\geq 10\mu F$</td> </tr> <tr> <td>$\leq 7\%$</td> <td colspan="2">0603 $\geq 0.33\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0201 $\geq 0.1\mu F$; 0402 $\geq 0.10\mu F$; 0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">$\leq 3.5\%$</td> <td>$\leq 12.5\%$</td> <td colspan="2">0402 $\geq 0.47\mu F$</td> </tr> <tr> <td>$\leq 5\%$</td> <td colspan="2">0201 $\geq 0.01\mu F$; 0402 $\geq 0.033\mu F$; 0603 $\geq 0.15\mu F$; 0805 $\geq 0.68\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 4.7\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0201 $\geq 0.1\mu F$; 0402 $\geq 0.22\mu F$; 0603 $> 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">$\leq 5\%$</td> <td>$\leq 12.5\%$</td> <td colspan="2">0402 $\geq 1\mu F$; 0805 $\geq 10\mu F$</td> </tr> <tr> <td>$\leq 15\%$</td> <td colspan="2">0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$</td> </tr> <tr> <td>$\leq 10\%$</td> <td colspan="2">0201 $\geq 0.012\mu F$; 0402 $\geq 0.22\mu F$; 0603 $\geq 0.33\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 22\mu F$</td> </tr> <tr> <td>6.3V</td> <td>$\leq 10\%$</td> <td>$\leq 15\%$</td> <td colspan="2">0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$; 0603 $\geq 10\mu F$; 0805 $\geq 4.7\mu F$; 1206 $\geq 47\mu F$; 1210 $\geq 100\mu F$</td> </tr> <tr> <td>4V</td> <td>$\leq 15\%$</td> <td>---</td> <td colspan="2">0402 $\geq 2.2\mu F$</td> </tr> </tbody> </table> | | | | X7S: | | | | Rated vol. | D.F. \leq | Exception of D.F. \leq | | $\geq 100V$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu F$ | | $\leq 5\%$ | 0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$ | | $\leq 10\%$ | 0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$ | | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu F$; 0805 $\geq 0.18\mu F$; 1206 $\geq 0.47\mu F$ | | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 1210 $\geq 3.3\mu F$ | | $\leq 10\%$ | 0402 $\geq 0.012\mu F$; 0603 $> 0.1\mu F$; 0805 $\geq 1\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$ | | 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$ | | 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 0805 $\geq 1\mu F$; 1210 $\geq 10\mu F$ | | $\leq 7\%$ | 0603 $\geq 0.33\mu F$ | | $\leq 10\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.10\mu F$; 0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ | | 16V | $\leq 3.5\%$ | $\leq 12.5\%$ | 0402 $\geq 0.47\mu F$ | | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 0402 $\geq 0.033\mu F$; 0603 $\geq 0.15\mu F$; 0805 $\geq 0.68\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 4.7\mu F$ | | $\leq 10\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.22\mu F$; 0603 $> 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ | | 10V | $\leq 5\%$ | $\leq 12.5\%$ | 0402 $\geq 1\mu F$; 0805 $\geq 10\mu F$ | | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$ | | $\leq 10\%$ | 0201 $\geq 0.012\mu F$; 0402 $\geq 0.22\mu F$; 0603 $\geq 0.33\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 22\mu F$ | | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$; 0603 $\geq 10\mu F$; 0805 $\geq 4.7\mu F$; 1206 $\geq 47\mu F$; 1210 $\geq 100\mu F$ | | 4V | $\leq 15\%$ | --- | 0402 $\geq 2.2\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | X7S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Rated vol. | D.F. \leq | Exception of D.F. \leq | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\geq 100V$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 5\%$ | 0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | $\leq 10\%$ | 0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu F$; 0805 $\geq 0.18\mu F$; 1206 $\geq 0.47\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 1210 $\geq 3.3\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\leq 10\%$ | 0402 $\geq 0.012\mu F$; 0603 $> 0.1\mu F$; 0805 $\geq 1\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 0805 $\geq 1\mu F$; 1210 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\leq 7\%$ | 0603 $\geq 0.33\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\leq 10\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.10\mu F$; 0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | $\leq 3.5\%$ | $\leq 12.5\%$ | 0402 $\geq 0.47\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\leq 5\%$ | 0201 $\geq 0.01\mu F$; 0402 $\geq 0.033\mu F$; 0603 $\geq 0.15\mu F$; 0805 $\geq 0.68\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 4.7\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\leq 10\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 0.22\mu F$; 0603 $> 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | $\leq 5\%$ | $\leq 12.5\%$ | 0402 $\geq 1\mu F$; 0805 $\geq 10\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\leq 10\%$ | 0201 $\geq 0.012\mu F$; 0402 $\geq 0.22\mu F$; 0603 $\geq 0.33\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 22\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$; 0603 $\geq 10\mu F$; 0805 $\geq 4.7\mu F$; 1206 $\geq 47\mu F$; 1210 $\geq 100\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | $\leq 15\%$ | --- | 0402 $\geq 2.2\mu F$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | * No evidence of damage or flash over during test. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

Multilayer Ceramic Capacitors

| No | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|--|----------------|-----------------------|--------------------|---|--|--|---|--|---|-----------------------|---------------|-----------------------|------------------------------|---------------|--------------------|---|-------------------|--|---|---|--|--|-------------|-------|------|--------------------|-----------------|--------------------|--------------------------|--|-------------------|--|--|------|------|---------------|---------------|---|---|---|-------------------|------------------|--|------|-----------|----------------|----------------|---|--------------------------|
| 5. | Insulation Resistance | *Test temp.: Room Temperature. *To apply rated voltage for MAX. 120sec. | 10GΩ or $RxC \geq 500\Omega \cdot F$ whichever is smaller. Class II (X7R, X7E, X5R, X6S, X7S) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <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 $RxC \geq 100 \Omega \cdot F$ 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; 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</td> </tr> <tr> <td>6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF</td> </tr> <tr> <td>4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF</td> </tr> </tbody> </table> | Rated voltage | Insulation Resistance | 100V: All X7R | 10GΩ or $RxC \geq 100 \Omega \cdot F$ 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; 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 | 6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF | 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: All X7R | 10GΩ or $RxC \geq 100 \Omega \cdot F$ 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; 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | Temperature Coefficient | With no electrical load. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X7S</td> <td>-55 ~ 125°C at 25°C</td> <td>X7S</td> <td>Within ±22%</td> </tr> <tr> <td>X5R</td> <td>-55~ 85°C at 25°C</td> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> <td>X6S</td> <td>Within ±22%</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>*0201X104/6.3V~25V: 0.5V 0201X224&474/10V: 0.5V</td> <td>*0201S104/6.3V~16V: 0.3V 0201S224/6.3V: 0.3V 0201X105/6.3V&10V: 0.3V</td> </tr> <tr> <th>0402</th> <th>0603</th> </tr> <tr> <td>Cap < 1μF: 1V</td> <td>Cap < 1μF: 1V</td> </tr> <tr> <td>Cap = 1μF: 0.5V** 0402B224-16V: 0.5V 0402B474-10V: 0.5V 0402X475M6R3: 0.5V</td> <td>1μF ≤ Cap ≤ 4.7μF: 0.5V 0603X106-10V: 0.5V</td> </tr> <tr> <td>1μF < Cap < 10μF: 0.2V **0402B105M6R3V: 0.2V</td> <td>Cap > 4.7μF: 0.2V</td> </tr> <tr> <td>Cap ≥ 10μF: 0.1V</td> <td></td> </tr> <tr> <th>0805</th> <th>1206/1210</th> </tr> <tr> <td>Cap < 10μF: 1V</td> <td>Cap ≤ 10μF: 1V</td> </tr> <tr> <td>Cap = 10μF: 0.5V 0805B475/6.3V~25V: 0.5V</td> <td>10μF < Cap ≤ 100μF: 0.5V</td> </tr> <tr> <td>Cap > 10μF: 0.2V</td> <td>Cap > 100μF: 0.2V 1206X107-6.3V: 0.2V</td> </tr> </tbody> </table> | T.C. | Operating Temp | T.C. | Capacitance Change | NPO | -55~125°C at 25°C | NPO | Within ±30ppm/°C | X7R | -55~125°C at 25°C | X7R | Within ±15% | X7S | -55 ~ 125°C at 25°C | X7S | Within ±22% | X5R | -55~ 85°C at 25°C | X5R | Within ±15% | X6S | -55~105°C at 25°C | X6S | Within ±22% | 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** | *0201X104/6.3V~25V: 0.5V 0201X224&474/10V: 0.5V | *0201S104/6.3V~16V: 0.3V 0201S224/6.3V: 0.3V 0201X105/6.3V&10V: 0.3V | 0402 | 0603 | Cap < 1μF: 1V | Cap < 1μF: 1V | Cap = 1μF: 0.5V** 0402B224-16V: 0.5V 0402B474-10V: 0.5V 0402X475M6R3: 0.5V | 1μF ≤ Cap ≤ 4.7μF: 0.5V 0603X106-10V: 0.5V | 1μF < Cap < 10μF: 0.2V **0402B105M6R3V: 0.2V | Cap > 4.7μF: 0.2V | Cap ≥ 10μF: 0.1V | | 0805 | 1206/1210 | Cap < 10μF: 1V | Cap ≤ 10μF: 1V | Cap = 10μF: 0.5V 0805B475/6.3V~25V: 0.5V | 10μF < Cap ≤ 100μF: 0.5V |
| T.C. | Operating Temp | T.C. | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPO | -55~125°C at 25°C | NPO | Within ±30ppm/°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | -55~125°C at 25°C | X7R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7S | -55 ~ 125°C at 25°C | X7S | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X5R | -55~ 85°C at 25°C | X5R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X6S | -55~105°C at 25°C | X6S | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *0201X104/6.3V~25V: 0.5V 0201X224&474/10V: 0.5V | *0201S104/6.3V~16V: 0.3V 0201S224/6.3V: 0.3V 0201X105/6.3V&10V: 0.3V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | 0603 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap < 1μF: 1V | Cap < 1μF: 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap = 1μF: 0.5V** 0402B224-16V: 0.5V 0402B474-10V: 0.5V 0402X475M6R3: 0.5V | 1μF ≤ Cap ≤ 4.7μF: 0.5V 0603X106-10V: 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1μF < Cap < 10μF: 0.2V **0402B105M6R3V: 0.2V | Cap > 4.7μF: 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap ≥ 10μF: 0.1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | 1206/1210 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap < 10μF: 1V | Cap ≤ 10μF: 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap = 10μF: 0.5V 0805B475/6.3V~25V: 0.5V | 10μF < Cap ≤ 100μF: 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap > 10μF: 0.2V | Cap > 100μF: 0.2V 1206X107-6.3V: 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

Multilayer Ceramic Capacitors

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | |
|------|---|---|---|------------|-------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|---|
| 7. | Adhesive Strength of Termination | * Pressurizing force : 2N (0201) and 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec. | * No remarkable damage or removal of the terminations. | | | | | | | | | | | | | | | |
| 8. | Vibration Resistance | * 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. | * No remarkable damage. * Cap change and Q/D.F.: To meet initial spec. | | | | | | | | | | | | | | | |
| 9. | Solderability | * Solder temperature: 235±5°C * Dipping time: 2±0.5 sec. | 95% min. coverage of all metalized area. | | | | | | | | | | | | | | | |
| 10. | Bending Test | * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec. * 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. | * No remarkable damage. * Cap change : NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: within ±12.5% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) | | | | | | | | | | | | | | | |
| 11. | Resistance to Soldering Heat | * Solder temperature: 260±5°C * 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. | * No remarkable damage. * Cap change: NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge. | | | | | | | | | | | | | | | |
| 12. | Temperature Cycle | * Conduct the five cycles according to the temperatures and time. <table border="1" style="margin-left: 20px;"> <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> * 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. | Step | Temp. (°C) | Time (min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2-3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2-3 | * No remarkable damage. * Cap change : NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. |
| Step | Temp. (°C) | Time (min.) | | | | | | | | | | | | | | | | |
| 1 | Min. operating temp. +0/-3 | 30±3 | | | | | | | | | | | | | | | | |
| 2 | Room temp. | 2-3 | | | | | | | | | | | | | | | | |
| 3 | Max. operating temp. +3/-0 | 30±3 | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 2-3 | | | | | | | | | | | | | | | | |

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

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%; **10V: 0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; * 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: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 4V | ≤ 20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

| No | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|---|--|--|--|---|---|-----------------------------------|-----|------|--|-----------------------------------|--|-----|------|---|-----|------|---|---------------------|---|---------------------|-----|------|--|--|-----|--------|---|---|------|-------|--|----|-------|-----|
| 14 | Humidity (Damp Heat) Load | *Test temp. : 40±2°C *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. | * 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%; **10V: 0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Q/D.F. value: NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C X7R, X5R, X6S, X7S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | ≤ 15% 0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TTseries 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | ≤ 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 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <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="6">500MΩ or RxC ≥ 5 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 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 ; All X6S/X7S items; Size ≥ 1812</td> <td></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 ; 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 ; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

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: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) 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%; **10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25% 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: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | Size | Dielectric | Rated voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0201 | X5R/X7R/ X6S/X7S | ≤ 10V | C ≥ 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≥ 16V | C > 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0402 | X5R | ≤ 16V | C > 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 25V, 50V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0402 | X6S | 6.3V, 10V | C > 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 16V, 25V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0603 | X5R/X7R/ X6S/X7S | 4V | C ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 6.3V, 10V | C ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0603 | X5R/X6S/X7S | 25V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | X7R | 35V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0805 | X5R/X7R/ X6S/X7S | 4V | C ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 6.3V | C ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0805 | X6S | 10V, 50V | C ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 16V | C > 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0805 | X7R/X7S | 16V, 25V | C ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | X5R | C ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1206 | X5R/X7R/X6S | ≤ 6.3V | C ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1210 | X5R/X7R/X6S | 16V | C ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | X7R | 100V | C ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT15 | X5R | 6.3V | C > 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT21 | X5R/X7R/X6S | ≤ 10V | C ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | ≤ 3% | ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 35V | ≤ 5% | ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤ 5% | ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 14% 0201 ≥ 0.1μF (0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤ 5% | ≤ 15% 0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TTseries | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (2) 150% of rated voltage for below range. | **1WV items must follow de-rating conditions. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <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>16V</td> <td>C ≥ 0.022μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X7R/X5R/ X6S</td> <td>50V</td> <td>C > 0.01μF</td> </tr> <tr> <td>10-25V</td> <td>C ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">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">0603</td> <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="2">0805</td> <td rowspan="2">X5R/X7R/ X6S/X7S</td> <td>10V, 16V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>100V</td> <td>C ≥ 0.47μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/ X6S/X7S</td> <td>50V</td> <td>C ≥ 0.68μF</td> </tr> <tr> <td>35V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X7R</td> <td>10-25V</td> <td>C ≥ 4.7μF</td> </tr> <tr> <td>100V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X5R/X6S/ X7S</td> <td>100V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td>50V</td> <td>C = 4.7μF</td> </tr> <tr> <td>1825 2220 2225</td> <td>X7R</td> <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 | 16V | C ≥ 0.022μF | 0402 | X7R/X5R/ X6S | 50V | C > 0.01μF | 10-25V | C ≥ 0.22μF | 0603 | X7S | 50V~100V | C > 0.22μF | X7R | 50V | C > 0.1μF | 0603 | X5R | 25V | C = 1.0μF | 50V | C ≥ 1.0μF | 0805 | X5R/X7R/ X6S/X7S | 10V, 16V | C ≥ 1.0μF | 100V | C ≥ 0.47μF | 0805 | X5R/X7R/ X6S/X7S | 50V | C ≥ 0.68μF | 35V | C ≥ 2.2μF | 1206 | X7R | 10-25V | C ≥ 4.7μF | 100V | C ≥ 1.0μF | 1210 | X5R/X6S/ X7S | 100V | C ≥ 2.2μF | 50V | C = 4.7μF | 1825 2220 2225 | X7R | 100V~250V | C ≥ 1.0μF | <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 ; 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 ; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size | Dielectric | Rated voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0201 | X5R/X6S | 16V, 25V | C = 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 16V | C ≥ 0.022μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | X7R/X5R/ X6S | 50V | C > 0.01μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10-25V | C ≥ 0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | X7S | 50V~100V | C > 0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | X7R | 50V | C > 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | X5R | 25V | C = 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X5R/X7R/ X6S/X7S | 10V, 16V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | C ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X5R/X7R/ X6S/X7S | 50V | C ≥ 0.68μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 35V | C ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206 | X7R | 10-25V | C ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1210 | X5R/X6S/ X7S | 100V | C ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C = 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1825 2220 2225 | X7R | 100V~250V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 ; All X6S/X7S items; Size ≥ 1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (3) ≤ 6.3V or C ≥ 10μF :150% of rated voltage. (4) 10V ≤ Ur < 250V: 200% of rated voltage. (5) 500V: 150% of rated voltage. (6) Ur ≥ 630V: 120% of rated voltage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| * 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: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

Multilayer Ceramic Capacitors

APPENDIXES

■ Tape & reel dimensions

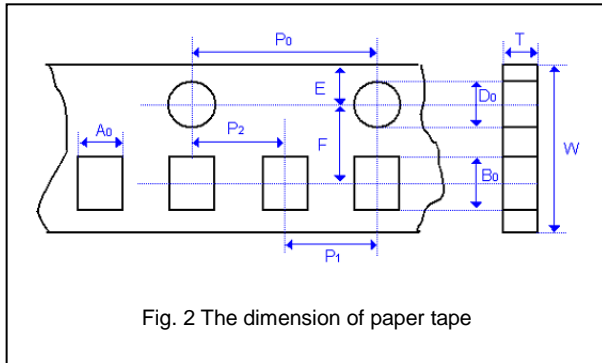


Fig. 2 The dimension of paper tape

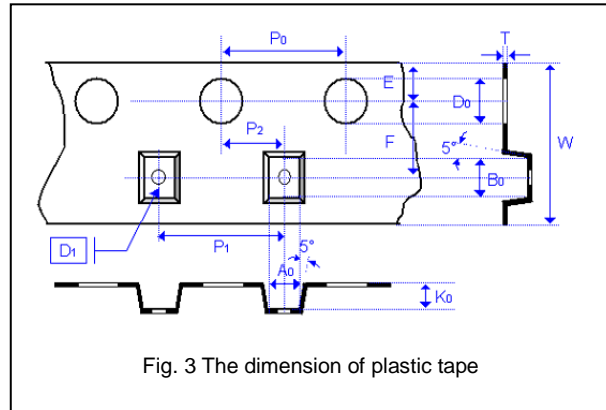


Fig. 3 The dimension of plastic tape

| Size | 0201 | 0402 | 0603 | 0805 | | | 1206 | | | | 1210 | | | | 1808 | | 1812 | | |
|-------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|--|
| Thickness | L | N,E | S,H,X | A,H | B,T | D,I | B,T | C,J,D | G,P | T | C,D | G,K | M | D,F | G,K | D,F | G,K | M,U | |
| 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 | < 3.05 | < 3.20 | < 2.50 | < 2.50 | < 3.90 | < 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 | < 3.80 | < 4.00 | < 5.30 | < 5.30 | < 5.30 | < 5.30 | < 5.30 | |
| T | ≤ 0.55 | ≤ 0.80 | ≤ 1.20 | ≤ 1.15 | ≤ 1.20 | 0.23 +/-0.1 | ≤ 1.20 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | |
| K₀ | - | - | - | - | - | < 2.00 | - | < 2.00 | < 2.50 | < 1.50 | < 2.00 | < 2.50 | < 3.20 | < 2.00 | < 2.50 | < 2.00 | < 2.50 | < 3.50 | |
| W | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | |
| 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 | 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 | 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 | 4.00 +/-0.10 | 4.00 +/-0.10 | 8.00 +/-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 +/-0.05 | 2.00 +/-0.10 | 2.00 +/-0.10 | 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 | 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 | 1.00 +/-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 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | |
| F | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | |

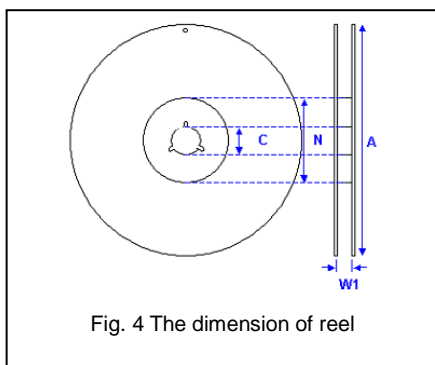
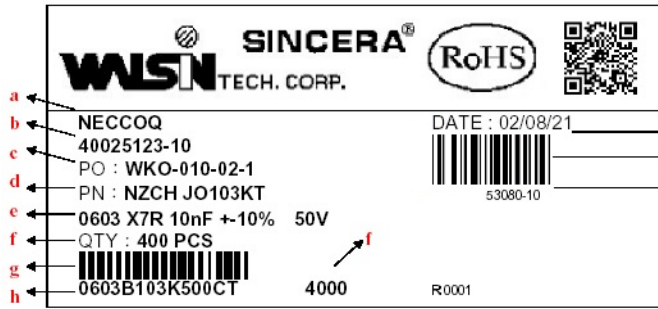


Fig. 4 The dimension of reel

| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | | 1812 |
|----------------------|------------------------------------|-----------|-----------|------------|
| Reel size | 7" | 10" | 13" | 7" |
| C | 13.0±0.5 | 13.0±0.5 | 13.0±0.5 | 13.0±0.5 |
| W₁ | 10.0±1.5 | 10.0±1.5 | 10.0±1.5 | 12.4±2.0/0 |
| A | 178.0±2.0 | 250.0±2.0 | 330.0±2.0 | 178.0±2.0 |
| N | 60.0±1.0/0 | 50 min | 50 min | 60.0±1.0/0 |

Multilayer Ceramic Capacitors

Example of customer label



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

*Customized label is available upon request

Constructions

| No. | Name | NPO | X7R, X5R, X6S, X7S |
|-----|------------------|--------------------------|--------------------------|
| ① | Ceramic material | CaZrO ₃ based | BaTiO ₃ based |
| ② | Inner electrode | | Ni |
| ③ | Termination | Inner layer | Cu |
| ④ | | Middle layer | Ni |
| ⑤ | | Outer layer | Sn |

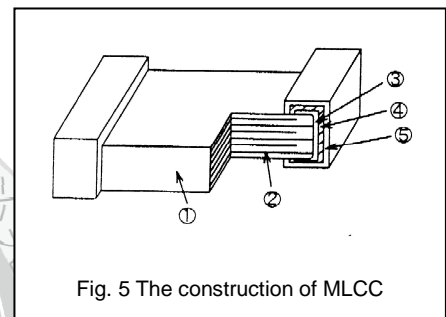


Fig. 5 The construction of MLCC

Storage and handling conditions

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

Cautions:

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

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.

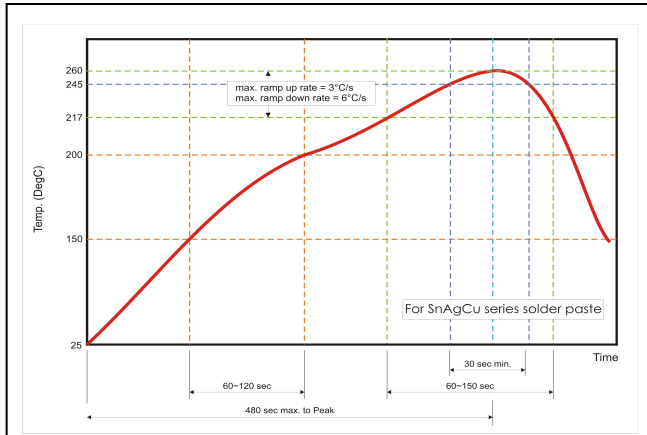


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

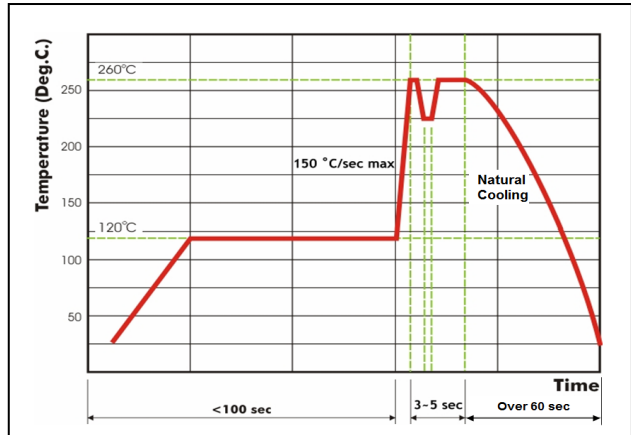


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

