

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, Y5V, X6S & X5R Dielectrics

RoHS Compliance

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

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.

Surge's MLCC is made by NP0, X7R, X6S, X5R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

2. FEATURES

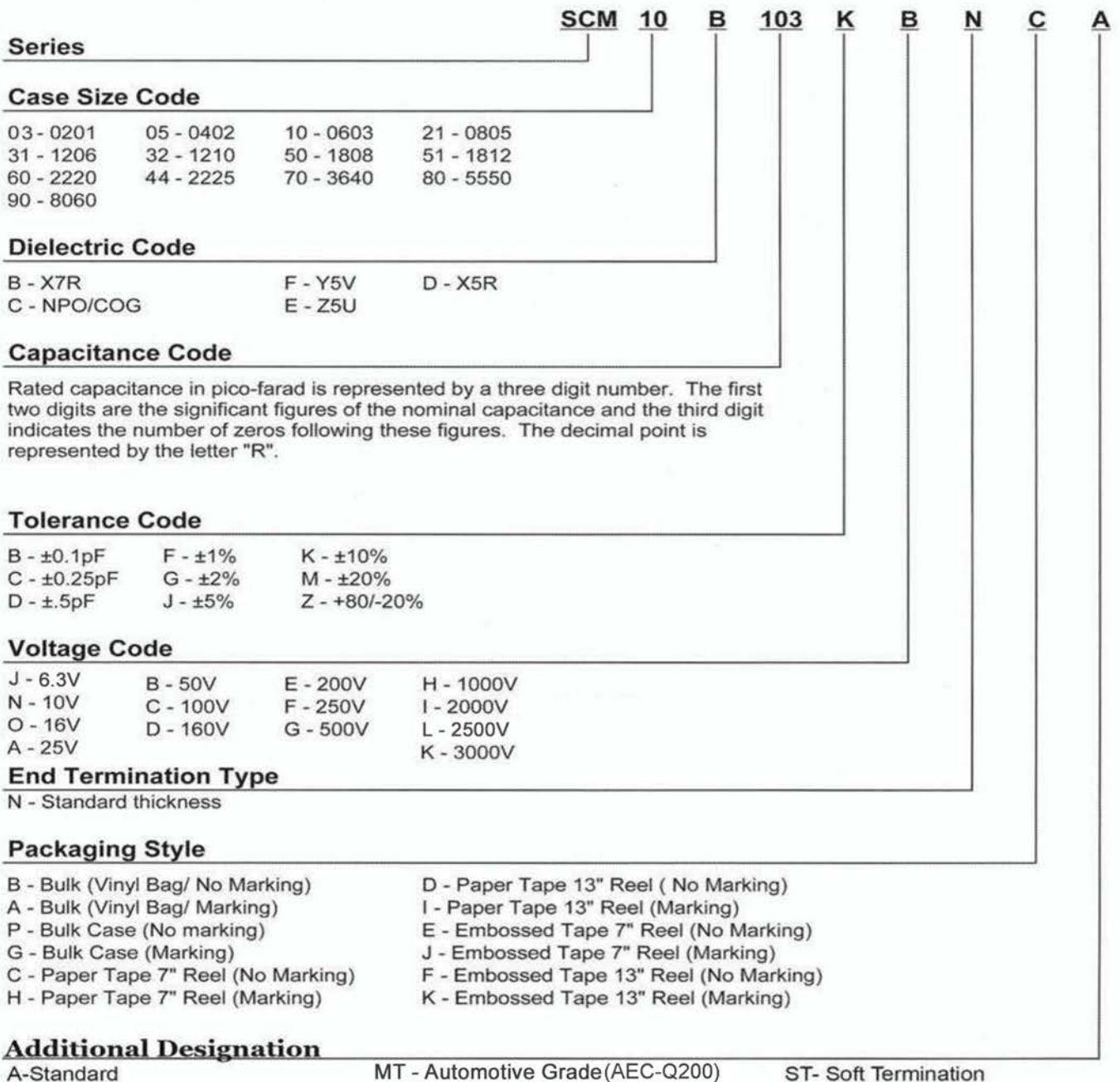
- a. A wide selection of sizes is available (0201 to 1812).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

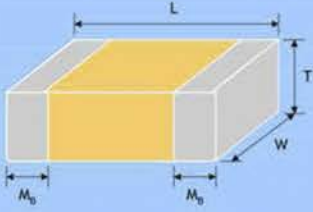
- a. For general digital circuit.
- b. For power supply bypass capacitors.
- c. For consumer electronics.
- d. For telecommunication.
- e. For automotive

4. HOW TO ORDER

PART NUMBERING SYSTEM



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} | | | 0.15+0.1/-0.05 |
| | 0402 (1005) | 1.00±0.05 | 0.50±0.05 | 0.50±0.05 | N | R | 0.25 |
| | | | | 0.50+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±0.10 | 0.80±0.10 | 0.80±0.07 | S | R / W | 0.40±0.15 |
| | | | | 0.50±0.10 | H | R / W | |
| | | 1.60+0.15/-0.10 | 0.80+0.15/-0.10 | 0.80+0.15/-0.10 | X | R / W | |
| | 0805 (2012) | 2.00±0.15 | 1.25±0.10 | 0.50±0.10 | H | R / W | 0.50±0.20 |
| | | | | 0.60±0.10 | A | R / W | |
| | | | | 0.80±0.10 | B | R / W | |
| | | | | 1.25±0.10 | D | R | |
| | | 2.00±0.20 | 1.25±0.20 | 0.85±0.10 | T | R / W | |
| | 1.25±0.20 | I | R | | | | |
| | 1206 (3216) | 3.20±0.15 | 1.60±0.15 | 0.80±0.10 | B | R / W | 0.60±0.20 (0.5±0.25) ^{***} |
| | | | | 0.95±0.10 | C | R | |
| | | | | 1.25±0.10 | D | R | |
| | | 3.20±0.20 | 1.60±0.20 | 1.15±0.15 | J | R | |
| 1.60±0.20 | | | | G | R | | |
| 0.85±0.10 | | | | T | R / W | | |
| 3.20 | 1.60 | 1.60+0.30/-0.10 | P | R | | | |
| 1210 (3225) | 3.20±0.30 | 2.50±0.20 | 0.95±0.10 | C | R | 0.75±0.25 | |
| | | | 0.85±0.10 | T | R | | |
| | | | 1.25±0.10 | D | R | | |
| | 3.20±0.40 | 2.50±0.30 | 1.60±0.20 | G | R | | |
| | | | 2.00±0.20 | K | R | | |
| | | | 2.50±0.30 | M | R | | |
| 1808 (4520) | 4.50±0.40 (4.5+0.5/-0.3) ^{**} | 2.03±0.25 | 1.25±0.10 | D | R | 0.75±0.25 (0.5±0.25) ^{***} | |
| | | | 1.40±0.15 | F | R | | |
| | | | 1.60±0.20 | G | R | | |
| | | | 2.00±0.20 | K | R | | |
| 1812 (4532) | 4.50±0.40 (4.5+0.5/-0.3) ^{**} | 3.20±0.30 | 1.25±0.10 | D | R | 0.75±0.25 (0.5±0.25) ^{***} | |
| | | | 1.60±0.20 | G | R | | |
| | | | 2.00±0.20 | K | R | | |
| | 3.20±0.40 | 2.50±0.30 | M | R | | | |
| | | 2.80±0.30 | U | R | | | |

* R = Reflow soldering process; W = Wave soldering process.
 ** For 1808_200V ~3kV, 1812_200V~3kV and safety certificated products.
 *** For 1206_1000V ~3kV, 1808_200V ~3kV, 1812_200V~3kV and safety certificated products.
 #1: For 0603/Cap ≥ 10µF or 0603(>10V)/Cap>1µF products.
 #2: For 0201/Cap ≥ 0.68µF products.
 #3: For 0201/Cap >1µF products.

6. GENERAL ELECTRICAL DATA

| Dielectric | NP0 | X7R | Y5V | X5R | X6S |
|----------------------------|--|-----------------------------------|---------------------------|------------------------------|-----------------------|
| Size | 0402, 0603, 0805, 1206, 1210, 1812 | | | | |
| Capacitance range* | 0.1pF to 0.1μF | 100pF to 47μF | 0.01μF to 100μF | 100pF to 220μF | 0.1μF to 100μF |
| Capacitance tolerance** | Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%) | J (±5%), K (±10%), M (±20%) | M (±20%), Z (-20/+80%) | K (±10%), M (±20%) | K (±10%), M (±20%) |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V, 100V | 6.3V, 10V, 16V, 25V, 50V, 100V | | 4V, 6.3V, 10V, 16V, 25V, 50V | |
| DF(Tan δ)* | Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000 | Note 1 | | | |
| Operating temperature | -55 to +125°C | | -25 to +85°C | -55 to +85°C | -55 to +105°C |
| Capacitance characteristic | ±30ppm | ±15% | +30/-80% | ±15% | ±22% |
| Termination | Ni/Sn (lead-free termination) | | | | |

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

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

X7R/X6S/X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

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

Note 1:

X7R/X5R/X6S

| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | |
|------------|--------|---------------------|--|
| ≥100V | ≤2.5% | ≤3% | 1206 ≥ 0.47μF |
| | | ≤5% | 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; TT series |
| 50V | ≤2.5% | ≤3% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF |
| | | ≤5% | 1210 ≥ 4.7μF |
| | | ≤10% | 0402 ≥ 0.1μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series |
| 35V | ≤3.5% | ≤10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF |
| 25V | ≤3.5% | ≤5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF |
| | | ≤7% | 0603 ≥ 0.33μF; 1206 ≥ 4.7μF |
| | | ≤10% | 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series |
| | | ≤12.5% | 0402 ≥ 1μF |
| 16V | ≤3.5% | ≤5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF |
| | | ≤10% | 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series |
| 10V | ≤5% | ≤10% | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series |
| | | ≤15% | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF |
| 6.3V | ≤10% | ≤15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series |
| | | ≤20% | 0402 ≥ 2.2μF |
| 4V | ≤15% | --- | --- |

Y5V

| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | |
|---------------|--------|---------------------|---|
| ≥50V | 5% | 7% | 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF |
| 35V | 7% | --- | --- |
| 25V | 5% | 7% | 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF |
| | | 9% | 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF |
| 16V (C<1.0μF) | 7% | 9% | 0402 ≥ 0.068μF; 0603 ≥ 0.68μF |
| | | 12.5% | 0402 ≥ 0.22μF |
| 16V (C≥1.0μF) | 9% | 12.5% | 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF |
| 10V | 12.5% | 20% | 0402 ≥ 0.47μF |
| 6.3V | 20% | --- | --- |

7. CAPACITANCE RANGE

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

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

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

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

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

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

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

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|---------------|------|----|----|----|----|------|----|----|----|----|------|-----|----|----|----|----|------|-----|----|----|----|----|-----|-----|----|----|----|----|-----|
| | | 0201 | | | | | 0402 | | | | | 0603 | | | | | | 0805 | | | | | | | | | | | | |
| SIZE | | 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 | 6.3 | 10 | 16 | 25 | 50 | 100 |
| RATED VOLTAGE (VDC) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 1,500pF (152) | L | L | L | L | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 1,800pF (182) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 2,200pF (222) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 2,700pF (272) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 3,300pF (332) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 3,900pF (392) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 4,700pF (472) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 5,600pF (562) | L | L | | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 6,800pF (682) | L | L | | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 8,200pF (822) | L | L | | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 0.010µF (103) | L | L | L | | | | N | N | N | N | | | S | S | S | S | S | | B | B | B | B | B | | | | | | |
| | 0.012µF (123) | | | | | | | N | N | N | | | | S | S | S | S | X | | B | B | B | B | B | | | | | | |
| | 0.015µF (153) | | | | | | | N | N | N | | | | S | S | S | S | X | | B | B | B | B | B | | | | | | |
| | 0.018µF (183) | | | | | | | N | N | N | | | | S | S | S | S | X | | B | B | B | B | B | | | | | | |
| | 0.022µF (223) | | | | | | | N | N | N | N | | | S | S | S | S | X | | B | B | B | B | B | | | | | | |
| | 0.027µF (273) | | | | | | | N | N | N | N | | | S | S | S | S | X | | B | B | B | B | B | D | | | | | |
| | 0.033µF (333) | | | | | | | N | N | N | N | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | |
| | 0.039µF (393) | | | | | | | N | N | N | | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | |
| | 0.047µF (473) | | | | | | | N | N | N | N | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | |
| | 0.056µF (563) | | | | | | | N | N | | | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | |
| 0.068µF (683) | | | | | | | N | N | | N | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | | |
| 0.082µF (823) | | | | | | | N | N | | | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | | |
| 0.10µF (104) | | | | | | N | N | N | N | N | | | S | S | S | X | X | | B | B | B | B | B | D | | | | | | |
| 0.12µF (124) | | | | | | | | | | | | | S | S | X | | | | B | B | B | D | | | | | | | | |
| 0.15µF (154) | | | | | | | | | | | | | S | S | X | | | | D | D | D | D | | | | | | | | |
| 0.18µF (184) | | | | | | | | | | | | | S | S | X | | | | D | D | D | D | | | | | | | | |
| 0.22µF (224) | | | | | | N | N | N | N | | | | S | S | X | X | | | D | D | D | D | T | | | | | | | |
| 0.27µF (274) | | | | | | | | | | | | X | X | X | X | | | | D | D | D | I | | | | | | | | |
| 0.33µF (334) | | | | | | | | | | | | X | X | X | X | | | | D | D | D | I | | | | | | | | |
| 0.39µF (394) | | | | | | | | | | | | X | X | X | X | | | | D | D | D | 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 | | | | | | | | | |
| 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 | | | | | | I | I | I | I | | | | | | | | |
| 3.3µF (335) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.7µF (475) | | | | | | | | | | | | | | | | | | | 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.

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

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

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

7-3. Y5V Dielectric 0402, 0603, 0805 Sizes

| DIELECTRIC | | Y5V | | | | | | | | | | | | | | | |
|---------------------|---------------|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|-----|
| SIZE | | 0402 | | | | | 0603 | | | | | 0805 | | | | | |
| RATED VOLTAGE (VDC) | | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 0.010µF (103) | | N | N | N | N | | S | S | S | S | | A | A | A | A | B |
| | 0.015µF (153) | | N | N | N | N | | S | S | S | S | | A | A | A | A | B |
| | 0.022µF (223) | | N | N | N | N | | S | S | S | S | | A | A | A | A | B |
| | 0.033µF (333) | | N | N | N | N | | S | S | S | S | | A | A | A | A | B |
| | 0.047µF (473) | | N | N | N | N | | S | S | S | S | | A | A | A | A | B |
| | 0.068µF (683) | | N | N | N | | | S | S | S | S | | A | A | A | A | B |
| | 0.10µF (104) | | N | N | N | | | S | S | S | S | | A | A | A | A | B |
| | 0.15µF (154) | | | N | N | | | S | S | S | S | | A | A | A | A | |
| | 0.22µF (224) | N | N | N | | | | S | S | S | S | | A | A | A | A | |
| | 0.33µF (334) | N | N | N | | | | S | S | S | X | | B | B | B | B | |
| | 0.47µF (474) | N | N | N | | | | S | S | X | X | | B | B | B | B | |
| | 0.68µF (684) | N | | | | | | S | X | X | | | B | B | D | D | |
| | 1.0µF (105) | N | N | | | | | S | X | X | | | B | B | D | D | |
| | 1.5µF (155) | | | | | | | S | | | | | D | D | | | |
| | 2.2µF (225) | | | | | | S | S | X | | | | D | D | I | | |
| | 3.3µF (335) | | | | | | | | | | | | D | D | | | |
| | 4.7µF (475) | | | | | | X | X | | | | | D | D | I | | |
| 6.8µF (685) | | | | | | | | | | | | | I | | | | |
| 10µF (106) | | | | | | | | | | | | I | I | I | | | |
| 22µF (226) | | | | | | | | | | | | I | I | | | | |

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

7-3. Y5V Dielectric 1206, 1210, 1812 Sizes

| DIELECTRIC | | Y5V | | | | | | | | | | | | | | | | |
|---------------------|---------------|------|----|----|----|----|------|-----|----|----|----|------|-----|----|----|----|----|-----|
| SIZE | | 1206 | | | | | 1210 | | | | | 1812 | | | | | | |
| RATED VOLTAGE (VDC) | | 6.3 | 10 | 16 | 25 | 50 | 100 | 6.3 | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 0.010µF (103) | | B | B | B | B | B | | | | | | C | | | | | D |
| | 0.015µF (153) | | B | B | B | B | B | | | | | | C | | | | | D |
| | 0.022µF (223) | | B | B | B | B | B | | | | | | C | | | | | D |
| | 0.033µF (333) | | B | B | B | B | B | | | | | | C | | | | | D |
| | 0.047µF (473) | | B | B | B | B | B | | | | | | C | | | | | D |
| | 0.068µF (683) | | B | B | B | B | B | | | | | | C | | | | | D |
| | 0.10µF (104) | | B | B | B | B | B | | C | C | C | C | C | D | D | D | D | D |
| | 0.15µF (154) | | B | B | B | B | B | C | C | C | C | C | C | D | D | D | D | D |
| | 0.22µF (224) | | B | B | B | B | B | C | C | C | C | C | C | D | D | D | D | D |
| | 0.33µF (334) | | B | B | B | B | | | C | C | C | C | C | D | D | D | D | D |
| | 0.47µF (474) | | B | B | B | B | | | C | C | C | C | | D | D | D | D | D |
| | 0.68µF (684) | | B | B | B | B | | | C | C | C | C | | D | D | D | D | D |
| | 1.0µF (105) | | C | C | C | C | | | C | C | C | C | | D | D | D | D | D |
| | 1.5µF (155) | | C | C | C | | | | C | C | C | | | D | D | D | D | |
| | 2.2µF (225) | | C | C | C | J | | | C | C | C | G | | D | D | D | D | |
| | 3.3µF (335) | | J | J | J | | | | C | C | C | | | D | D | D | D | |
| | 4.7µF (475) | | J | J | J | P | | | C | C | D | G | | D | D | D | D | |
| 6.8µF (685) | | J | J | | | | | C | C | D | | | D | D | D | D | | |
| 10µF (106) | | J | J | P | | | | D | D | G | | | D | D | D | K | | |
| 22µF (226) | | P | P | | | | | | K | K | | | | | | | | |
| 47µF (476) | P | | | | | | | K | K | | | | | M | | | | |
| 100µF (107) | | | | | | | | M | | | | | | | | | | |

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

7-4. X5R Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

| Dielectric | | X5R | | | | | | | | | | | | | | |
|---------------------|---------------|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|
| Size | | 0201 | | | | | 0402 | | | | | 0603 | | | | |
| Rated Voltage (VDC) | | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 | 6.3 | 10 | 16 | 25 | 50 |
| Capacitance | 100pF (101) | | | L | L | L | | | | | | | | | | |
| | 120pF (121) | | | L | L | L | | | | | | | | | | |
| | 150pF (151) | | | L | L | L | | | | | | | | | | |
| | 180pF (181) | | | L | L | L | | | | | | | | | | |
| | 220pF (221) | | | L | L | L | | | | | | | | | | |
| | 270pF (271) | | | L | L | L | | | | | | | | | | |
| | 330pF (331) | | | L | L | L | | | | | | | | | | |
| | 390pF (391) | | | L | L | L | | | | | | | | | | |
| | 470pF (471) | | | L | L | L | | | | | | | | | | |
| | 560pF (561) | | | 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 | | | | | | | | | | | | |
| | 2,200pF (222) | | L | L | | | | | | | | | | | | |
| | 2,700pF (272) | | L | L | | | | | | | | | | | | |
| | 3,300pF (332) | | L | L | | | | | | | | | | | | |
| | 4,700pF (472) | | L | L | | | | | | | | | | | | |
| | 6,800pF (682) | | L | | | | | | | | | | | | | |
| | 0.010µF (103) | L | L | L | L | | | | | | | | | | | |
| | 0.015µF (153) | L | L | | | | | | | | | | | | | |
| | 0.022µF (223) | L | L | | | | | | | | | | | | | |
| | 0.027µF (273) | L | L | | | | | | N | | | | | | | |
| | 0.033µF (333) | L | L | | | | | | N | | | | | | | |
| | 0.039µF (393) | L | L | | | | | | N | | | | | | | |
| | 0.047µF (473) | L | L | | | | | | N | | | | | | | |
| | 0.056µF (563) | L | L | | | | | | N | N | | | | | | |
| | 0.068µF (683) | L | L | | | | | | N | N | | | | | | |
| | 0.082µF (823) | L | L | | | | N | N | N | | | | | | | |
| | 0.10µF (104) | L | L | L | L | | N | N | N | N | N | | | | | |
| 0.15µF (154) | | | | | | N | N | N | N | | | | | | | |
| 0.22µF (224) | L | L | | | | N | N | N | N | N | | | | X | X | |
| 0.27µF (274) | | | | | | | | | | | | | X | X | X | |
| 0.33µF (334) | | | | | | N | N | | | | | X | X | X | X | |
| 0.39µF (394) | | | | | | | | | | | | X | X | X | X | |
| 0.47µF (474) | L | | | | | N | N | E | E | E | | X | X | X | X | |
| 0.68µF (684) | | | | | | N | N | | | | | X | X | X | X | |
| 0.82µF (824) | | | | | | | | | | | | X | X | X | | |
| 1.0µF (105) | L | L | | | | N | N | N | N | | | X | X | X | X | |
| 1.5µF (155) | | | | | | | | | | | | X | | | | |
| 2.2µF (225) | L | | | | | N | N | E | E | | | X | X | X | X | |
| 3.3µF (335) | | | | | | | | | | | | X | X | | | |
| 4.7µF (475) | | | | | | E | E | | | | | X | X | X | X | |
| 6.8µF (685) | | | | | | | | | | | | | | | | |
| 10µF (106) | | | | | | E | | | | | | X | X | X | X | |
| 22µF (226) | | | | | | | | | | | | X | X | | | |

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

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

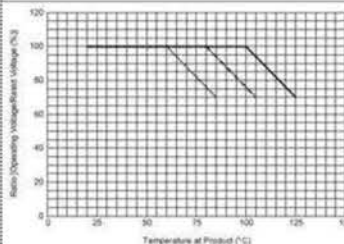
9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|--|-----------|---|--|---|---|--|--|--|---------------|-----------------------|---------------|---|---|---------------------------------|---|--|--|---|--|---|-----|--------------|-----------------------------|--|------------|--|---|---|-------|--------------|-----------------------------|--|-------------|--|-----|------------|-------------|--|-------------|---|------|-------------|-------------|---|-------------|----------------------------|----|-------------|-----|-----|
| 1. | Visual and Mechanical | --- | <ul style="list-style-type: none"> * No remarkable defect. * Dimensions to conform to individual specification sheet. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | Capacitance | Class I: (NP0) | * Shall not exceed the limits given in the detailed spec. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | Q/ D.F. (Dissipation Factor) | $\leq 1000\text{pF}, 1.0\pm 0.2\text{Vrms} \cdot 1\text{MHz}\pm 10\%$ $> 1000\text{pF}, 1.0\pm 0.2\text{Vrms} \cdot 1\text{KHz}\pm 10\%$ Class II: (X7R, X7E, X6S, X5R, Y5V) $C \leq 10\mu\text{F}, 1.0\pm 0.2\text{Vrms} \cdot 1\text{KHz}\pm 10\%$ ** $C > 10\mu\text{F}, 0.5\pm 0.2\text{Vrms} \cdot 120\text{Hz}\pm 20\%$ | NP0: $\text{Cap} \geq 30\text{pF}, Q \geq 1000; \text{Cap} < 30\text{pF}, Q \geq 400+20C$ X7R, X5R, X6S: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <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="2">$\geq 100\text{V}$</td> <td>$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td>1206 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td></td> <td>$\leq 5\%$</td> <td>0805 $> 0.1\mu\text{F}$; 0603 $\geq 0.068\mu\text{F}$; 1206 $> 1\mu\text{F}$; TT series</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="2">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td>0201(50V); 0603 $\geq 0.047\mu\text{F}$; 0805 $\geq 0.18\mu\text{F}$; 1206 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td>$\leq 5\%$</td> <td>1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$</td> <td>0402 $\geq 0.1\mu\text{F}$; 0603 $> 0.1\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$; TT series</td> </tr> <tr> <td>35V</td> <td>$\leq 3.5\%$</td> <td>$\leq 10\%$</td> <td>0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="2">$\leq 3.5\%$</td> <td>$\leq 5\%$</td> <td>0201 $\geq 0.01\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>$\leq 7\%$</td> <td>0603 $\geq 0.33\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$</td> <td>0402 $\geq 0.10\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 6.8\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">$\leq 3.5\%$</td> <td>$\leq 5\%$</td> <td>0201 $\geq 0.01\mu\text{F}$; 0402 $\geq 0.033\mu\text{F}$; 0603 $\geq 0.15\mu\text{F}$; 0805 $\geq 0.68\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$</td> <td>0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">$\leq 5\%$</td> <td>$\leq 10\%$</td> <td>0201 $\geq 0.012\mu\text{F}$; 0402 $\geq 0.33\mu\text{F}$ (0402/X7R $\geq 0.22\mu\text{F}$); TT series</td> </tr> <tr> <td>$\leq 15\%$</td> <td>0603 $\geq 0.33\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 22\mu\text{F}$</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">$\leq 10\%$</td> <td>$\leq 15\%$</td> <td>0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0603 $\geq 10\mu\text{F}$; 0805 $\geq 4.7\mu\text{F}$; 1206 $\geq 47\mu\text{F}$; 1210 $\geq 100\mu\text{F}$; TT series</td> </tr> <tr> <td>$\leq 20\%$</td> <td>0402 $\geq 2.2\mu\text{F}$</td> </tr> <tr> <td>4V</td> <td>$\leq 15\%$</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. \leq | Exception of D.F. \leq | | $\geq 100\text{V}$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu\text{F}$ | | $\leq 5\%$ | 0805 $> 0.1\mu\text{F}$; 0603 $\geq 0.068\mu\text{F}$; 1206 $> 1\mu\text{F}$; TT series | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu\text{F}$; 0805 $\geq 0.18\mu\text{F}$; 1206 $\geq 0.47\mu\text{F}$ | $\leq 5\%$ | 1210 $\geq 4.7\mu\text{F}$ | $\leq 10\%$ | 0402 $\geq 0.1\mu\text{F}$; 0603 $> 0.1\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$; TT series | 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$ | 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1210 $\geq 10\mu\text{F}$ | $\leq 7\%$ | 0603 $\geq 0.33\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$ | $\leq 10\%$ | 0402 $\geq 0.10\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 6.8\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series | 16V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu\text{F}$; 0402 $\geq 0.033\mu\text{F}$; 0603 $\geq 0.15\mu\text{F}$; 0805 $\geq 0.68\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$ | $\leq 10\%$ | 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series | 10V | $\leq 5\%$ | $\leq 10\%$ | 0201 $\geq 0.012\mu\text{F}$; 0402 $\geq 0.33\mu\text{F}$ (0402/X7R $\geq 0.22\mu\text{F}$); TT series | $\leq 15\%$ | 0603 $\geq 0.33\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 22\mu\text{F}$ | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0603 $\geq 10\mu\text{F}$; 0805 $\geq 4.7\mu\text{F}$; 1206 $\geq 47\mu\text{F}$; 1210 $\geq 100\mu\text{F}$; TT series | $\leq 20\%$ | 0402 $\geq 2.2\mu\text{F}$ | 4V | $\leq 15\%$ | --- | --- |
| | | Rated vol. | D.F. \leq | Exception of D.F. \leq | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\geq 100\text{V}$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | $\leq 5\%$ | 0805 $> 0.1\mu\text{F}$; 0603 $\geq 0.068\mu\text{F}$; 1206 $> 1\mu\text{F}$; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu\text{F}$; 0805 $\geq 0.18\mu\text{F}$; 1206 $\geq 0.47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | $\leq 5\%$ | 1210 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\leq 10\%$ | 0402 $\geq 0.1\mu\text{F}$; 0603 $> 0.1\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1210 $\geq 10\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | $\leq 7\%$ | 0603 $\geq 0.33\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\leq 10\%$ | 0402 $\geq 0.10\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 6.8\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 16V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu\text{F}$; 0402 $\geq 0.033\mu\text{F}$; 0603 $\geq 0.15\mu\text{F}$; 0805 $\geq 0.68\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | $\leq 10\%$ | 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10V | $\leq 5\%$ | $\leq 10\%$ | 0201 $\geq 0.012\mu\text{F}$; 0402 $\geq 0.33\mu\text{F}$ (0402/X7R $\geq 0.22\mu\text{F}$); TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | $\leq 15\%$ | 0603 $\geq 0.33\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 22\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0603 $\geq 10\mu\text{F}$; 0805 $\geq 4.7\mu\text{F}$; 1206 $\geq 47\mu\text{F}$; 1210 $\geq 100\mu\text{F}$; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | $\leq 20\%$ | 0402 $\geq 2.2\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4V | $\leq 15\%$ | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Y5V: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Rated vol. | D.F. \leq | Exception of D.F. \leq | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\geq 50\text{V}$ | 5% | 7% | 0603 $\geq 0.1\mu\text{F}$; 0805 $\geq 0.47\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | 7% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | 5% | 7% | 0402 $\geq 0.047\mu\text{F}$; 0603 $\geq 0.1\mu\text{F}$; 0805 $\geq 0.33\mu\text{F}$; 1206 $\geq 1\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 16V (C < 1.0 μF) | 7% | 9% | 0402 $\geq 0.068\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 16V (C $\geq 1.0\mu\text{F}$) | 9% | 12.5% | 0603 $\geq 2.2\mu\text{F}$; 0805 $\geq 3.3\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; 1812 $\geq 47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 6.3V | 20% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. | Dielectric Strength | <ul style="list-style-type: none"> * To apply voltage ($\leq 100\text{V}$) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA. | * No evidence of damage or flash over during test. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. | Insulation Resistance | To apply rated voltage for max. 120 sec. | 10G Ω or Rx C $\geq 500\Omega \cdot \text{F}$ whichever is smaller. Class II (X7R, X5R, X6S, Y5V) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: X7R | 10G Ω or Rx C $\geq 100 \Omega \cdot \text{F}$ whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0603 $\geq 1\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0805 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0402 $\geq 1\mu\text{F}$; 0603 $\geq 2.2\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 10\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 $\geq 47\text{nF}$; 0402 $\geq 0.47\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V; 4V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| All X6S items | Rx C $\geq 50 \Omega \cdot \text{F}$. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 $\geq 0.1\mu\text{F}$; 0603 $\geq 2.2\mu\text{F}$; 0805 $\geq 10\mu\text{F}$; 1206 $\geq 10\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 $\geq 1\mu\text{F}$; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 10\mu\text{F}$; 1206 $\geq 22\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0603 $\geq 10\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 $> 0.1\mu\text{F}$; 0603 $\geq 10\mu\text{F}$; 0805 $\geq 47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 4V: 0603 $\geq 22\mu\text{F}$; 0805 $\geq 47\mu\text{F}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | |
|------|----------------------------------|---|--|----------------|-------------|-------------------|----------------------------|-------------------|-----|-------------------|-----|-------------------|----------------------------|-------------------|---|------------|--------------------|--|------------------|-----|-------------|-----|-------------|-----|-------------|-----|------------------|
| 6. | Temperature Coefficient | With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>-55~ 85°C at 25°C</td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> </tr> <tr> <td>Y5V</td> <td>-25~ 85°C at 20°C</td> </tr> </tbody> </table> | T.C. | Operating Temp | NPO | -55~125°C at 25°C | X7R | -55~125°C at 25°C | X5R | -55~ 85°C at 25°C | X6S | -55~105°C at 25°C | Y5V | -25~ 85°C at 20°C | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>X6S</td> <td>Within ±22%</td> </tr> <tr> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table> | T.C. | Capacitance Change | NPO | Within ±30ppm/°C | X7R | Within ±15% | X5R | Within ±15% | X6S | Within ±22% | Y5V | Within +30%/-80% |
| T.C. | Operating Temp | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPO | -55~125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | -55~125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| X6S | -55~105°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y5V | -25~ 85°C at 20°C | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T.C. | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPO | Within ±30ppm/°C | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X5R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X6S | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y5V | Within +30%/-80% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | Adhesive Strength of Termination | * Pressurizing force : 1N (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.) * Measurement to be made after keeping at room temp. for 24±2 hrs. | * 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. * Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage. * Cap change : NPO: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) | | | | | | | | | | | | | | | | | | | | | | | | |
| 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): Perform 150+0/-10°C for 1 hr and 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: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20% * 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"> <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): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. | 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 : NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. | | | | | | | | | |
| Step | Temp. (°C) | Time (min.) | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 2 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Max. operating temp. +3/-0 | 30±3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | | | | | | | | | |

| 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): Perform 150+0/-10°C for 1 hr and 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: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; TT series & C≥ 1uF, within ±25% **10V: 0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% * Q/D.F. value: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C X7R, X5R, X6S: | | | | | | | | | | | | | | | | | | | | | | | |
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| Y5V: | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, Y5V) | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 14 | Humidity (Damp Heat) Load | <p>* Test temp.: 40±2°C * Humidity: 90~95%RH * Test time: 500+24/-0 hrs. * To apply voltage : rated voltage. * Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</p> | <p>* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C≥1uF, within ±25% **10V: 0603 ≥4.7μF; 0402 ≥1μF; 0201 ≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C X7R, X5R, X6S:</p> <table border="1"> <thead> <tr> <th>Rated V.D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥100V ≤3%</td> <td>≤6% 1206 ≥0.47μF ≤7.5% 0805 >0.1μF, 0603 ≥0.068μF, 1206 >1μF; TT series</td> </tr> <tr> <td rowspan="2">≥50V ≤3%</td> <td>≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF</td> </tr> <tr> <td>≤10% 1210 ≥4.7μF</td> </tr> <tr> <td rowspan="2">35V ≤5%</td> <td>≤20% 0402 ≥0.1μF; 0603 >0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series</td> </tr> <tr> <td>≤10% 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td rowspan="3">25V ≤5%</td> <td>≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF</td> </tr> <tr> <td>≤14% 0603 ≥0.33μF; 1206 ≥4.7μF</td> </tr> <tr> <td>≤15% 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series</td> </tr> <tr> <td rowspan="2">16V ≤5%</td> <td>≤20% 0402 ≥1μF</td> </tr> <tr> <td>≤10% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF</td> </tr> <tr> <td rowspan="2">10V ≤7.5%</td> <td>≤15% 0201 ≥0.01μF; 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series</td> </tr> <tr> <td>≤20% 0201 ≥0.012μF; 0402 ≥0.33μF(0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF</td> </tr> <tr> <td>6.3V ≤15%</td> <td>≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series</td> </tr> <tr> <td>4V ≤20%</td> <td>---</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>7.5%</td> <td>10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF</td> </tr> <tr> <td>15% 0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF</td> </tr> <tr> <td>16V (C<1.0μF)</td> <td>10%</td> <td>12.5% 0402 ≥0.068μF; 0603 ≥0.68μF 20% 0402 ≥0.22μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>12.5%</td> <td>20% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30% 0402 ≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7">500MΩ or RxC ≥5 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 ≥0.1μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF</td> </tr> <tr> <td>35V: 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td>25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF</td> </tr> <tr> <td>16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF</td> </tr> <tr> <td>10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF</td> </tr> <tr> <td>6.3V ; 4V ; TT series ; All X6S items</td> </tr> </tbody> </table> | Rated V.D.F. ≤ | Exception of D.F. ≤ | ≥100V ≤3% | ≤6% 1206 ≥0.47μF ≤7.5% 0805 >0.1μF, 0603 ≥0.068μF, 1206 >1μF; TT series | ≥50V ≤3% | ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF | ≤10% 1210 ≥4.7μF | 35V ≤5% | ≤20% 0402 ≥0.1μF; 0603 >0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series | ≤10% 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF | 25V ≤5% | ≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF | ≤14% 0603 ≥0.33μF; 1206 ≥4.7μF | ≤15% 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series | 16V ≤5% | ≤20% 0402 ≥1μF | ≤10% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF | 10V ≤7.5% | ≤15% 0201 ≥0.01μF; 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series | ≤20% 0201 ≥0.012μF; 0402 ≥0.33μF(0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF | 6.3V ≤15% | ≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series | 4V ≤20% | --- | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥50V | 7.5% | 10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF | 35V | 10% | --- | 25V | 7.5% | 10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF | 15% 0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF | 16V (C<1.0μF) | 10% | 12.5% 0402 ≥0.068μF; 0603 ≥0.68μF 20% 0402 ≥0.22μF | 16V (C≥1.0μF) | 12.5% | 20% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF; | 10V | 20% | 30% 0402 ≥0.47μF | 6.3V | 30% | --- | Rated voltage | Insulation Resistance | 100V: X7R | 500MΩ or RxC ≥5 Ω-F whichever is smaller. | 50V: 0402 ≥0.1μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF | 35V: 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF | 25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF | 16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF | 10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF | 6.3V ; 4V ; TT series ; All X6S items |
| | | | Rated V.D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | ≥100V ≤3% | ≤6% 1206 ≥0.47μF ≤7.5% 0805 >0.1μF, 0603 ≥0.068μF, 1206 >1μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | ≥50V ≤3% | ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤10% 1210 ≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 35V ≤5% | ≤20% 0402 ≥0.1μF; 0603 >0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | 25V ≤5% | ≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤14% 0603 ≥0.33μF; 1206 ≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤15% 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 16V ≤5% | ≤20% 0402 ≥1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤10% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 10V ≤7.5% | ≤15% 0201 ≥0.01μF; 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤20% 0201 ≥0.012μF; 0402 ≥0.33μF(0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 4V ≤20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥50V | 7.5% | 10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | 10% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | 7.5% | 10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 15% 0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C<1.0μF) | 10% | 12.5% 0402 ≥0.068μF; 0603 ≥0.68μF 20% 0402 ≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C≥1.0μF) | 12.5% | 20% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | 20% | 30% 0402 ≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | 30% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: X7R | 500MΩ or RxC ≥5 Ω-F whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 ≥0.1μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V ; 4V ; TT series ; All X6S items | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| No | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--|------------------------|---------------------|------------------------|-------------------|------|-------------|-------|-----------|------|--------------------|----------------|-----------|----|----------|------|-------------|---------------------|------------------------|----|----------|------|-------------|------|----------|---------|----------|------|-------------|------|----------|-----|-------|-----------|------|-------------|-----|----------|------|-----|-----------|-----------|------|-----|------|----------|------|-----|------|----------|------|------------|---------------|-------------|------|------------|---------|-----------|------|--------------------|-----|-----------|--------|------------|------|-------------------|-----|------------|--------|------------------------|------|-------------------|--------|------------------------|-----|-----------|------|-------------------|------|------------|-----|-----------|------|-----|------|-----------|---|------------|--------|---------------------|--------|------|--------------------|--|-------|------|---|--------------------|-----|------|--|---|-----|------|--|-----------------------------------|-----|------|--|------------------|-----|--------|--|--|------|-------|--|--|----|-------|---|------------|--------|---------------------|-------|------|---|-----|-----|-----|-----|------|---|--|-----------------|-----|--|-----------------|-------|--|-----|-----|-------------------|------|-----|-----|---------------|-----------------------|-----------|---|---|--|--|--|---|---------------------------------------|
| 15. | High Temperature Load (Endurance) | <p>*Test temp. : NP0, X7R/X7E: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C</p> <p>*Test time: 1000+24/-0 hrs.</p> <p>*To apply voltage: (1) ≤ 6.3V or C ≥ 10μF or TT series: 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R/X7R/X6S</td> <td>≤ 10V</td> <td>C ≥ 0.1μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X6S Y5V</td> <td>6.3V, 10V, 25V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>4V</td> <td>C ≥ 22μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6S</td> <td>6.3V, 10V, 25V, 35V</td> <td>C ≥ 4.7μF C ≥ 1.0μF</td> </tr> <tr> <td>4V</td> <td>C ≥ 47μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6S</td> <td>6.3V</td> <td>C ≥ 22μF</td> </tr> <tr> <td>10V~50V</td> <td>C ≥ 10μF</td> </tr> <tr> <td rowspan="2">1206</td> <td>X5R/X7R/X6S</td> <td>6.3V</td> <td>C ≥ 47μF</td> </tr> <tr> <td>NP0</td> <td>3000V</td> <td>C ≥ 1.5pF</td> </tr> <tr> <td>1210</td> <td>X5R/X7R/X6S</td> <td>16V</td> <td>C ≥ 47μF</td> </tr> <tr> <td>TT18</td> <td>Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td>TT21</td> <td>Y5V</td> <td>6.3V</td> <td>C ≥ 10μF</td> </tr> <tr> <td>TT31</td> <td>Y5V</td> <td>6.3V</td> <td>C ≥ 22μF</td> </tr> </tbody> </table> <p>**1WV items must follow de-rating conditions (6) 150% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R/X7R/X6</td> <td>16V/25V</td> <td>C ≥ 0.1μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X6S Y5V</td> <td>50V</td> <td>C ≥ 0.1μF</td> </tr> <tr> <td>10~25V</td> <td>C ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6 Y5V</td> <td>16V</td> <td>C ≥ 0.47μF</td> </tr> <tr> <td>10~50V</td> <td>C ≥ 1.0μF C ≥ 2.2μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6 Y5V</td> <td>10~50V</td> <td>C ≥ 4.7μF C ≥ 2.2μF</td> </tr> <tr> <td>50V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X5R/X7R/X6 X7R</td> <td>100V</td> <td>C ≥ 0.47μF</td> </tr> <tr> <td>16V</td> <td>C ≥ 4.7μF</td> </tr> <tr> <td>2220</td> <td>X7R</td> <td>100V</td> <td>C ≥ 6.8μF</td> </tr> </tbody> </table> <p>*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24±2 hrs ** De-rating conditions:</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Product for 125°C</p> <p>Product for 105°C</p> <p>Product for 85°C</p> </div> </div> | Size | Dielectric | Rated voltage | Capacitance range | 0201 | X5R/X7R/X6S | ≤ 10V | C ≥ 0.1μF | 0402 | X5R/X7R/X6S Y5V | 6.3V, 10V, 25V | C ≥ 1.0μF | 4V | C ≥ 22μF | 0603 | X5R/X7R/X6S | 6.3V, 10V, 25V, 35V | C ≥ 4.7μF C ≥ 1.0μF | 4V | C ≥ 47μF | 0805 | X5R/X7R/X6S | 6.3V | C ≥ 22μF | 10V~50V | C ≥ 10μF | 1206 | X5R/X7R/X6S | 6.3V | C ≥ 47μF | NP0 | 3000V | C ≥ 1.5pF | 1210 | X5R/X7R/X6S | 16V | C ≥ 47μF | TT18 | Y5V | 6.3V, 10V | C ≥ 2.2μF | TT21 | Y5V | 6.3V | C ≥ 10μF | TT31 | Y5V | 6.3V | C ≥ 22μF | Size | Dielectric | Rated voltage | Capacitance | 0201 | X5R/X7R/X6 | 16V/25V | C ≥ 0.1μF | 0402 | X5R/X7R/X6S Y5V | 50V | C ≥ 0.1μF | 10~25V | C ≥ 0.22μF | 0603 | X5R/X7R/X6 Y5V | 16V | C ≥ 0.47μF | 10~50V | C ≥ 1.0μF C ≥ 2.2μF | 0805 | X5R/X7R/X6 Y5V | 10~50V | C ≥ 4.7μF C ≥ 2.2μF | 50V | C ≥ 2.2μF | 1206 | X5R/X7R/X6 X7R | 100V | C ≥ 0.47μF | 16V | C ≥ 4.7μF | 2220 | X7R | 100V | C ≥ 6.8μF | <p>* No remarkable damage.</p> <p>Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V: 0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40%</p> <p>Q/D.F. value: NP0: More than 30pF, Q ≥ 350 10pF ≤ C < 30pF, Q ≥ 275+2.5C Less than 10pF, Q ≥ 200+10C</p> <p>X7R, X5R, X6S:</p> <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="2">≥ 100V</td> <td rowspan="2">≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5% 0805 > 0.1μF, 0603 ≥ 0.068μF, 1206 > 1μF; TT series</td> </tr> <tr> <td rowspan="2">≥ 50V</td> <td rowspan="2">≤ 3%</td> <td>≤ 6% 0201(50V):0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10% 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤ 5%</td> <td>≤ 20% 0402 ≥ 0.1μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td>≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 14% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 5%</td> <td>≤ 15% 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 20% 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 15% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 15%</td> <td>≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20% 0201 ≥ 0.1μF ; 0402 ≥ 1μF; TT series</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50V</td> <td>7.5%</td> <td>10% 0603 ≥ 0.1μF; 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0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1uF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1uF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V ; 4V ; TT series ; All X6S items</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF | ≤ 7.5% 0805 > 0.1μF, 0603 ≥ 0.068μF, 1206 > 1μF; TT series | ≥ 50V | ≤ 3% | ≤ 6% 0201(50V):0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 10% 1210 ≥ 4.7μF | 35V | ≤ 5% | ≤ 20% 0402 ≥ 0.1μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF | 25V | ≤ 5% | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 14% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF | 16V | ≤ 5% | ≤ 15% 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series | ≤ 20% 0402 ≥ 1μF | 10V | ≤ 7.5% | ≤ 15% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | ≤ 15% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series | 6.3V | ≤ 15% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 20% 0201 ≥ 0.1μF ; 0402 ≥ 1μF; TT series | 4V | ≤ 20% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥ 50V | 7.5% | 10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF | 35V | 10% | --- | 25V | 7.5% | 10% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF | 15% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | 16V (C < 1.0μF) | 10% | 12.5% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF 20% 0402 ≥ 0.22μF | 16V (C ≥ 1.0μF) | 12.5% | 20% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; | 10V | 20% | 30% 0402 ≥ 0.47μF | 6.3V | 30% | --- | Rated voltage | Insulation Resistance | 100V: X7R | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | 50V: 0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0201 ≥ 0.1uF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1uF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V ; 4V ; TT series ; All X6S items |
| | | Size | Dielectric | Rated voltage | Capacitance range | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0201 | X5R/X7R/X6S | ≤ 10V | C ≥ 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0402 | X5R/X7R/X6S Y5V | 6.3V, 10V, 25V | C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 4V | C ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0603 | X5R/X7R/X6S | 6.3V, 10V, 25V, 35V | C ≥ 4.7μF C ≥ 1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 4V | C ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 0805 | X5R/X7R/X6S | 6.3V | C ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 10V~50V | C ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1206 | X5R/X7R/X6S | 6.3V | C ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | NP0 | 3000V | C ≥ 1.5pF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1210 | X5R/X7R/X6S | 16V | C ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT18 | Y5V | 6.3V, 10V | C ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT21 | Y5V | 6.3V | C ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TT31 | Y5V | 6.3V | C ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size | Dielectric | Rated voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0201 | X5R/X7R/X6 | 16V/25V | C ≥ 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | X5R/X7R/X6S Y5V | 50V | C ≥ 0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10~25V | C ≥ 0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | X5R/X7R/X6 Y5V | 16V | C ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10~50V | C ≥ 1.0μF C ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X5R/X7R/X6 Y5V | 10~50V | C ≥ 4.7μF C ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C ≥ 2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206 | X5R/X7R/X6 X7R | 100V | C ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 16V | C ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2220 | X7R | 100V | C ≥ 6.8μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 7.5% 0805 > 0.1μF, 0603 ≥ 0.068μF, 1206 > 1μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 50V | ≤ 3% | ≤ 6% 0201(50V):0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 10% 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | ≤ 5% | ≤ 20% 0402 ≥ 0.1μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤ 5% | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 14% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤ 5% | ≤ 15% 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0402 ≥ 1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤ 7.5% | ≤ 15% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 15% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤ 15% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤ 20% 0201 ≥ 0.1μF ; 0402 ≥ 1μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤ 20% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated vol. | D.F. ≤ | Exception of D.F. ≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ 50V | 7.5% | 10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | 10% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | 7.5% | 10% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 15% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C < 1.0μF) | 10% | 12.5% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF 20% 0402 ≥ 0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C ≥ 1.0μF) | 12.5% | 20% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | 20% | 30% 0402 ≥ 0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | 30% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | Insulation Resistance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V: X7R | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V: 0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V: 0201 ≥ 0.1uF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V: 0201 ≥ 0.1uF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V ; 4V ; TT series ; All X6S items | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

APPENDIXES

Tape & reel dimensions

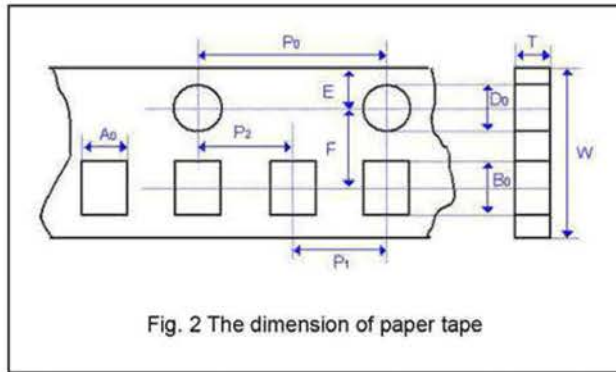


Fig. 2 The dimension of paper tape

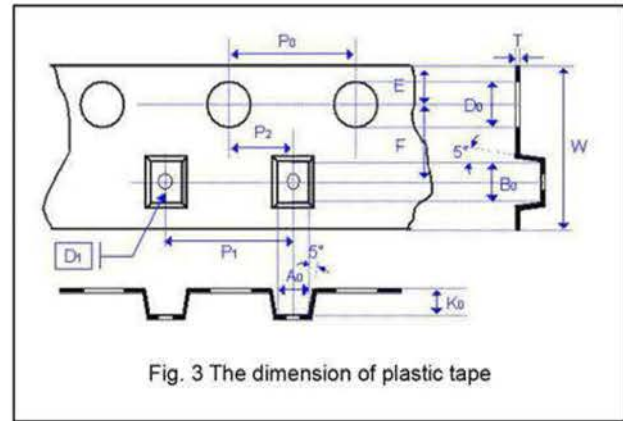


Fig. 3 The dimension of plastic tape

| Size | 0201 | | | 0402 | | | 0603 | | | 0805 | | | 1206 | | | 1210 | | | 1812 | | |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|--|--|------|--|--|
| Thickness | L | N | E | S, X | A, H | B, T | C, D, I | B, T | C, J, D | G, P | C, D | F, G, K | M | D, F, G, K | M | U | | | | | |
| A ₀ | 0.38±0.05 | 0.62±0.05 | 0.70±0.10 | 1.02±0.05 | 1.50±0.10 | 1.50±0.10 | <1.57 | 2.00±0.10 | <1.85 | <1.95 | <2.97 | <2.97 | <2.97 | <3.81 | <3.81 | <3.90 | | | | | |
| B ₀ | 0.68±0.05 | 1.12±0.05 | 1.20±0.10 | 1.80±0.05 | 2.30±0.10 | 2.30±0.10 | <2.40 | 3.50±0.10 | <3.46 | <3.67 | <3.73 | <3.73 | <3.73 | <5.30 | <5.30 | <5.30 | | | | | |
| T | 0.42±0.05 | 0.60±0.05 | 0.70±0.10 | 0.95±0.05 | 0.75±0.05 | 0.95±0.05 | 0.23±0.05 | 0.95±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 | | | | | |
| K ₀ | - | - | - | - | - | - | <2.50 | - | <2.50 | <2.50 | <2.50 | <2.50 | <3.00 | <2.50 | <3.00 | <3.50 | | | | | |
| W | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | | | | | |
| P ₀ | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | | | | | |
| 10xP ₀ | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | | | | | |
| P ₁ | 2.00±0.05 | 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 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | | | | | |
| P ₂ | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | | | | | |
| D ₀ | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.10 | | | | | |
| D ₁ | - | - | - | - | - | - | 1.00±0.10 | - | 1.00±0.10 | 1.00±0.10 | 1.00±0.10 | 1.00±0.10 | 1.00±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | | | | | |
| E | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 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±0.05 | 5.50±0.05 | 5.50±0.05 | | | | | |

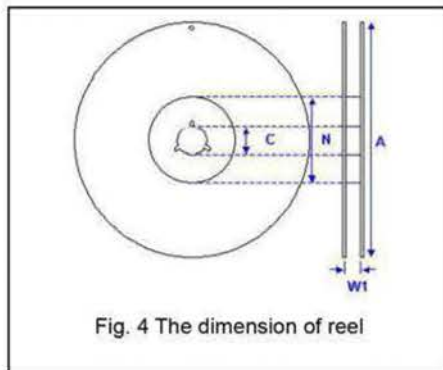


Fig. 4 The dimension of reel

| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | | 1812 |
|----------------|------------------------------------|---------------|---------------|---------------|
| Reel size | 7" | 10" | 13" | 7" |
| C | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 |
| W ₁ | 8.4+1.5/-0 | 8.4+1.5/-0 | 8.4+1.5/-0 | 12.4+2.0/-0 |
| A | 178.0±0.10 | 250.0±1.0 | 330.0±1.0 | 178.0±0.10 |
| N | 60.0+1.0/-0 | 100.0±1.0 | 100±1.0 | 60.0+1.0/-0 |

■ **Constructions**

| No. | Name | NPO, X7R, X5R, X6S, Y5V |
|-----|------------------|--------------------------|
| ① | Ceramic material | BaTiO ₃ based |
| ② | Inner electrode | Ni |
| ③ | Termination | Inner layer |
| ④ | | Middle layer |
| ⑤ | | Outer layer |

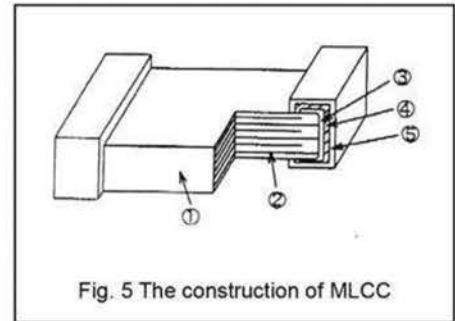


Fig. 5 The construction of MLCC

■ **Storage and handling conditions**

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

Cautions:

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

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.

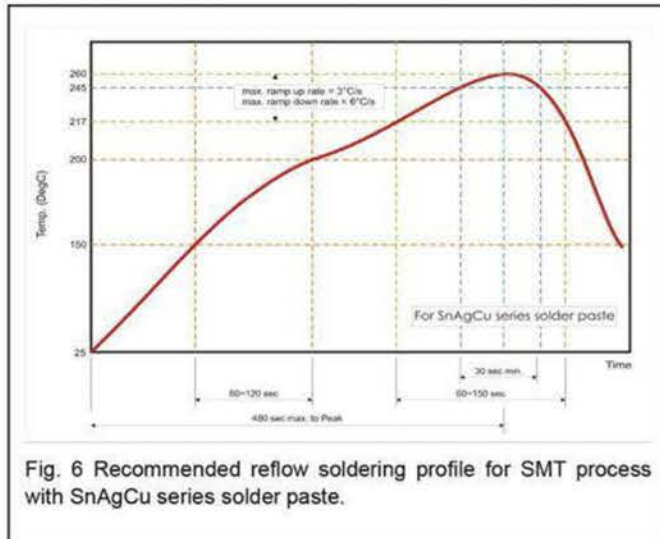


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

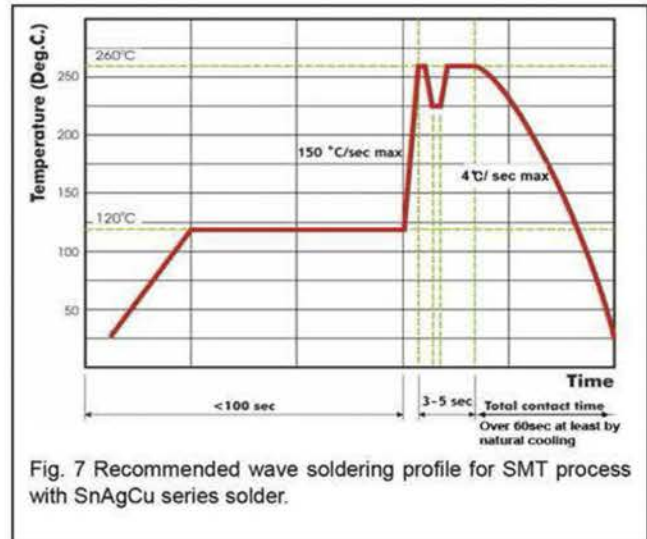


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.