

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, Y5V, X6S, X7S & 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.

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

## 3. APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.

## 4. HOW TO ORDER

| <u>1206</u>   | <u>B</u>  | <u>104</u>   | <u>K</u>  | <u>500</u>  | <u>C</u>           | <u>I</u>                                    |
|---|---|--|---|---|--------------------|---|
| <u>Size</u>   | <u>Dielectric</u>   | <u>Capacitance</u>   | <u>Tolerance</u>  | <u>Rated voltage</u>  | <u>Termination</u> | <u>Packaging style</u>                      |
| Inch (mm)<br><b>0201</b> (0603)<br><b>0402</b> (1005)<br><b>0603</b> (1608)<br><b>0805</b> (2012)<br><b>1206</b> (3216)<br><b>1210</b> (3225)<br><b>1812</b> (4532) | <b>N</b> =NP0<br>(C0G)<br><b>B</b> =X7R<br><b>F</b> =Y5V<br><b>X</b> =X5R<br><b>S</b> =X6S<br><b>A</b> =X7S | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>104=10x10 <sup>4</sup><br>=100nF | <b>A</b> =±0.05pF<br><b>B</b> =±0.1pF<br><b>C</b> =±0.25pF<br><b>D</b> =±0.5pF<br><b>F</b> =±1%<br><b>G</b> =±2%<br><b>J</b> =±5%<br><b>K</b> =±10%<br><b>M</b> =±20%<br><b>Z</b> =-20/+80% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br><b>4R0</b> =4 VDC<br><b>6R3</b> =6.3 VDC<br><b>100</b> =10 VDC<br><b>160</b> =16 VDC<br><b>250</b> =25 VDC<br><b>500</b> =50 VDC<br><b>101</b> =100 VDC | <b>C</b> =Cu/Ni/Sn | <b>T</b> =7" reeled<br><b>G</b> =13" reeled |

## 5. EXTERNAL DIMENSIONS

| Outline                           | Size<br>Inch (mm)                         | L (mm)                  | W (mm)                  | T (mm)/Symbol          |   | Soldering<br>Method *                  | M <sub>B</sub> (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 <sup>#2</sup>  | 0.3±0.05 <sup>#2</sup>  | 0.3±0.05 <sup>#2</sup> |   |  | 0.15±0.1/-0.05                         |
|                                   |   | 0.6±0.09 <sup>#3</sup>  | 0.3±0.09 <sup>#3</sup>  | 0.3±0.09 <sup>#3</sup> |   |  |  |
|                                   | 0402 (1005)                               | 1.00±0.05               | 0.50±0.05               | 0.50±0.05              | N | R                                      | 0.25                                   |
|                                   |   |                         |                         | 0.50+0.02/-0.05        | Q | R                                      |  |
|                                   |   | 1.00±0.20               | 0.50±0.20               | 0.5±0.20               | E | R                                      | +0.05/-0.10                            |
|                                   | 0603 (1608)                               | 1.60+0.15/-0.10         | 0.80+0.15/-0.10         | 0.80±0.07              | S | R / W                                  | 0.40±0.15                              |
|                                   |   |                         |                         | 0.50±0.10              | H | R / W                                  |  |
|                                   |   | 1.60±0.20 <sup>#1</sup> | 0.80±0.20 <sup>#1</sup> | 0.8±0.20 <sup>#1</sup> | 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<br>(0.5±0.25) <sup>***</sup> |
|                                   |   |                         |                         | 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                  |   |  |  |
| 1210 (3225)                       | 3.20±0.30                                 | 2.50±0.20               | 0.95±0.10               | C                      | R | 0.75±0.25                              |  |
|                                   |   |                         | 0.85±0.10               | T                      | R |  |  |
|                                   |   |                         | 1.25±0.10               | D                      | R |  |  |
|                                   | 3.20±0.40                                 | 2.50±0.30               | 1.60±0.20               | G                      | R |  |  |
|                                   |   |                         | 2.00±0.20               | K                      | R |  |  |
|                                   |   |                         | 2.50±0.30               | M                      | R |  |  |
| 3.20±0.60 <sup>#4</sup>           | 2.50±0.50 <sup>#4</sup>                   | 2.50±0.50 <sup>#4</sup> |                         |                        |   |  |  |
| 1808 (4520)                       | 4.50±0.40<br>(4.5+0.5/-0.3) <sup>**</sup> | 2.03±0.25               | 1.25±0.10               | D                      | R | 0.75±0.25<br>(0.5±0.25) <sup>***</sup> |  |
|                                   |   |                         | 1.40±0.15               | F                      | R |  |  |
|                                   |   |                         | 1.60±0.20               | G                      | R |  |  |
|                                   |   |                         | 2.00±0.20               | K                      | R |  |  |
| 1812 (4532)                       | 4.50±0.40<br>(4.5+0.5/-0.3) <sup>**</sup> | 3.20±0.30               | 1.25±0.10               | D                      | R | 0.75±0.25<br>(0.5±0.25) <sup>***</sup> |  |
|                                   |   |                         | 1.60±0.20               | G                      | R |  |  |
|                                   |   |                         | 2.00±0.20               | K                      | R |  |  |
|                                   |   |                         | 2.50±0.30               | M                      | R |  |  |
|                                   |   | 3.20±0.40               | 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/Cap ≥ 4.7μF (≤ 6.3V) or 0603/Cap > 1μF (> 10V) products.

#2 : For 0201/Cap ≥ 0.68μF products.

#3 : For 0201/Cap ≥ 1μF products.

#4 : For 1210\_100V: Cap > 1μF, 250V: Cap > 0.47μF, 400V~630V: Cap > 0.22μF.

## 6. GENERAL ELECTRICAL DATA

| Dielectric                 | NPO   | X7R                               | Y5V                       | X5R                   | X6S                   | X7S                   |
|----------------------------|---|-----------------------------------|---------------------------|-----------------------|-----------------------|-----------------------|
| Size                       | 0201, 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        | 1μF to 100μF          |
| Capacitance tolerance**    | Cap≤5pF <sup>#1</sup> :<br>A (±0.05pF), B (±0.1pF),<br>C (±0.25pF)<br>5pF<Cap<10pF:<br>C (±0.25pF), D (±0.5pF)<br>Cap≥10pF:<br>F (±1%), G (±2%),<br>J (±5%), K (±10%) | J (±5%),<br>K (±10%),<br>M (±20%) | M (±20%),<br>Z (-20/+80%) | K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) |
| Rated voltage (WVDC)       | 10V, 16V, 25V, 50V, 100V  | 6.3V, 10V, 16V, 25V, 50V, 100V    |                           |                       |                       |                       |
| DF(Tan δ)*                 | Cap<30pF: Q≥400+20C<br>Cap≥30pF: Q≥1000   | Note 1                            |                           |                       |                       |                       |
| Operating temperature      | -55 to +125°C   |                                   | -25 to +85°C              | -55 to +85°C          | -55 to +105°C         | -55 to +125°C         |
| Capacitance characteristic | ±30ppm  | ±15%                              | +30/-80%                  | ±15%                  | ±22%                  | ±22%                  |
| Termination                | Ni/Sn (lead-free termination)   |                                   |                           |                       |                       |                       |

#1: NPO, 0.1pF product only provide B tolerance; 0603N0R4 provide B&C tolerance; 0603N0R3 only provide C tolerance.

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

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

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

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 and then leave in ambient condition for 24±2 hours before measurement.

Note 1:

### X7R/X5R/X6S/X7S

| Rated vol. | D.F. ≤  | Exception of D.F. ≤  |
|------------|---------|--|
| ≥ 100V     | ≤ 2.5%  | ≤ 3% 1206 ≥ 0.47μF   |
|            |         | ≤ 5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series                               |
|            |         | ≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF  |
| 50V        | ≤ 2.5%  | ≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |
|            |         | ≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF   |
|            |         | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series                 |
| 35V        | ≤ 3.5%  | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |
| 25V        | ≤ 3.5%  | ≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF  |
|            |         | ≤ 7% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF   |
|            |         | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series |
|            | ≤ 12.5% | 0402 ≥ 0.47μF  |
| 16V        | ≤ 3.5%  | ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF         |
|            |         | ≤ 10% 0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 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; 01R5                                   |
| 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; TT series                            |
|                 |         | ≤ 12.5% 1210 ≥ 6.8μF   |
| 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; TT series             |
| 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; TT series |
| 10V             | ≤ 12.5% | ≤ 20% 0402 ≥ 0.47μF  |
| 6.3V            | ≤ 20%   | ---  |

## 7. CAPACITANCE RANGE

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

| DIELECTRIC          |             | NP0  |    |    |      |    |    |    |      |    |    |    |    |      |    |    |    |    |     |
|---------------------|-------------|------|----|----|------|----|----|----|------|----|----|----|----|------|----|----|----|----|-----|
| SIZE                |             | 0201 |    |    | 0402 |    |    |    | 0603 |    |    |    |    | 0805 |    |    |    |    |     |
| 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  |      | S  | S  | S  | S  |      |    |    |    |    |     |
|                     | 0.4pF (0R4) | L    | L  | L  | N    | N  | N  | N  |      | S  | S  | S  | S  |      |    |    |    |    |     |
|                     | 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   |
|                     | 2.0pF (2R0) | 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   |
|                     | 3.0pF (3R0) | 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   |
|                     | 4.0pF (4R0) | 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   |
|                     | 5.0pF (5R0) | 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   |
|                     | 6.0pF (6R0) | 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   |
|                     | 7.0pF (7R0) | L    | L  | L  | N    | N  | N  | N  | N    | S  | S  | S  | S  | S    | A  | A  | A  | A  | A   |
|                     | 8.0pF (8R0) | 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   |
|                     | 9.0pF (9R0) | 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) |      | L  | L  | 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)         |             | L    |    | N  | N    | N  | N  | N  | S    | S  | S  | S  | S  | A    | A  | A  | A  | A  |     |
| 330pF (331)         |             | L    |    | N  | N    | N  | N  | N  | S    | S  | S  | S  | S  | A    | A  | A  | A  | A  |     |
| 390pF (391)         |             | L    |    | N  | N    | N  | N  | N  | S    | S  | S  | S  | S  | B    | B  | B  | B  | B  |     |
| 470pF (471)         |             | L    |    | N  | N    | N  | N  | N  | S    | S  | S  | S  | S  | B    | B  | B  | B  | B  |     |
| 560pF (561)         |             | L    |    | 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  |    | 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  |    | B    | B  | B  | B  | B  |     |
| 2,200pF (222)       |             |      |    |    |      |    |    |    | X    | X  | X  | X  |    | B    | B  | B  | B  | B  |     |
| 2,700pF (272)       |             |      |    |    |      |    |    |    | X    | X  | X  | X  |    | D    | D  | D  | D  | D  |     |
| 3,300pF (332)       |             |      |    |    |      |    |    |    | X    | X  | X  | X  |    | D    | D  | D  | D  | D  |     |
| 3,900pF (392)       |             |      |    |    |      |    |    |    | X*   | X* | X* | X* |    | D    | D  | D  | D  | D  |     |
| 4,700pF (472)       |             |      |    |    |      |    |    |    | X*   | X* | X* | X* |    | D    | D  | D  | D  | D  |     |
| 5,600pF (562)       |             |      |    |    |      |    |    |    | X*   | X* | X* | X* |    | D    | D  | D  | D  | D  |     |
| 6,800pF (682)       |             |      |    |    |      |    |    |    | X*   | X* | X* | X* |    | D    | D  | D  | D  | D  |     |
| 8,200pF (822)       |             |      |    |    |      |    |    |    | X*   | X* | X* | X* |    | D    | D  | D  | D  | D  |     |
| 0.010uF (103)       |             |      |    |    |      |    |    |    | X*   | X* | X* | X* |    | D    | D  | D  | D  | D  |     |
| 0.012uF (123)       |             |      |    |    |      |    |    |    |      |    |    |    |    | T*   | T* | T* | T* |    |     |
| 0.015uF (153)       |             |      |    |    |      |    |    |    |      |    |    |    |    | 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.  
 2. The letter in cell with "\*" mark is expressed capacitance tolerance "J" (±5%) only.  
 3. For more information about products with special capacitance or other data, please contact WTC local representative.

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

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

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

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

| DIELECTRIC          |               | X7R  |    |    |    |    |      |    |    |    |    |      |     |    |    |    |      |     |     |    |    |    |    |     |
|---------------------|---------------|------|----|----|----|----|------|----|----|----|----|------|-----|----|----|----|------|-----|-----|----|----|----|----|-----|
| SIZE                |               | 0201 |    |    |    |    | 0402 |    |    |    |    | 0603 |     |    |    |    | 0805 |     |     |    |    |    |    |     |
| RATED VOLTAGE (VDC) |               | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 100  | 6.3 | 10 | 16 | 25 | 50   | 100 | 6.3 | 10 | 16 | 25 | 50 | 100 |
| Capacitance         | 100pF (101)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 120pF (121)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 150pF (151)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 180pF (181)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 220pF (221)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 270pF (271)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 330pF (331)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 390pF (391)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 470pF (471)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 560pF (561)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 680pF (681)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 820pF (821)   |      |    | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 1,000pF (102) | L    | L  | L  | L  | L  |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 1,200pF (122) | L    | L  | L  | L  |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 1,500pF (152) | L    | L  | L  | L  |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 1,800pF (182) | L    | L  | L  |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 2,200pF (222) | L    | L  | L  |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 2,700pF (272) | L    | L  | L  |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 3,300pF (332) | L    | L  | L  | L  |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 3,900pF (392) | L    | L  | L  |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S    | S   |     | B  | B  | B  | B  | B   |
|                     | 4,700pF (472) | L    | L  | L  |    |    |      | N  | 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  | 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) |      | L  | L  |    |    |      | N  | N  | N  | E  |      |     | S  | S  | S  | S    | X   |     | B  | B  | B  | B  | B   |
|                     | 0.027μF (273) |      |    |    |    |    |      | N  | N  | N  |    |      |     | S  | S  | S  | S    | X   |     | B  | B  | B  | B  | D   |
|                     | 0.033μF (333) |      |    |    |    |    |      | N  | N  | N  | E  |      |     | S  | S  | S  | X    | X   |     | B  | B  | B  | B  | D   |
|                     | 0.039μF (393) |      |    |    |    |    |      | N  | N  | N  |    |      |     | S  | S  | S  | X    | X   |     | B  | B  | B  | B  | D   |
| 0.047μF (473)       |               |      |    |    |    |    | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X    |     | B   | B  | B  | B  | D  |     |
| 0.056μF (563)       |               |      |    |    |    |    | N    | N  | N  |    |    |      | S   | S  | S  | X  | X    |     | B   | B  | B  | B  | D  |     |
| 0.068μF (683)       |               |      |    |    |    |    | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X    |     | B   | B  | B  | B  | D  |     |
| 0.082μF (823)       |               |      |    |    |    |    | N    | N  | N  |    |    |      | S   | S  | S  | X  | X    |     | B   | B  | B  | B  | D  |     |
| 0.10μF (104)        |               |      |    |    |    | N  | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X    |     | B   | B  | B  | B  | D  |     |
| 0.12μF (124)        |               |      |    |    |    |    |      |    |    |    |    |      | S   | S  | X  |    |      |     | B   | B  | B  | B  | I  |     |
| 0.15μF (154)        |               |      |    |    |    |    |      |    |    |    |    |      | S   | S  | X  |    |      |     | D   | D  | D  | D  | I  |     |
| 0.18μF (184)        |               |      |    |    |    |    |      |    |    |    |    |      | S   | S  | X  |    |      |     | D   | D  | D  | D  | I  |     |
| 0.22μF (224)        |               |      |    |    |    | N  | N    | N  | N  |    |    |      | S   | S  | X  | X  |      |     | D   | D  | D  | D  | I  |     |
| 0.27μF (274)        |               |      |    |    |    |    |      |    |    |    |    | X    | X   | X  | X  |    |      |     | D   | D  | D  | I  |    |     |
| 0.33μF (334)        |               |      |    |    |    |    |      |    |    |    |    | X    | 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   | X  |    |    |      |     | I   | I  | I  | I  |    |     |
| 3.3μF (335)         |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |      |     |     |    |    |    |    |     |
| 4.7μF (475)         |               |      |    |    |    |    |      |    |    |    |    | X    |     |    |    |    |      |     | I   | I  | I  | I  |    |     |
| 6.8μF (685)         |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |      |     |     |    |    |    |    |     |
| 10μF (106)          |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |      |     | I   | I  | I* |    |    |     |
| 22μF (226)          |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |      |     |     |    |    |    |    |     |

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

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

| DIELECTRIC   | X7R           |     |    |    |    |    |    |      |     |    |    |    |      |     |    |    |    |    |     |
|--------------|---------------|-----|----|----|----|----|----|------|-----|----|----|----|------|-----|----|----|----|----|-----|
|              | 1206          |     |    |    |    |    |    | 1210 |     |    |    |    | 1812 |     |    |    |    |    |     |
|              | SIZE          | 6.3 | 10 | 16 | 25 | 35 | 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  | P  |      |     | K  | G  | M  | M    |     |    |    | M  | M  |     |
| 3.3μF (335)  |               | P   | P  | P  |    |    |    |      |     | K  | G  | M  |      |     |    |    |    |    |     |
| 4.7μF (475)  | P             | P   | P  | P  |    | P  |    |      |     | K  | K  | K  | M    | M   |    |    |    |    |     |
| 6.8μF (685)  |               |     |    |    |    |    |    |      |     |    |    |    |      |     |    |    |    |    |     |
| 10μF (106)   | P             | P   | P  | P  | P  |    |    |      |     | K  | K  | K  | M    |     |    |    |    |    |     |
| 22μF (226)   | P             | P   | P* |    |    |    |    |      |     | M  | M  | M  |      |     |    |    |    |    |     |
| 47μF (476)   |               |     |    |    |    |    |    |      | M   | M  |    |    |      |     |    |    |    |    |     |
| 100μF (107)  |               |     |    |    |    |    |    |      |     |    |    |    |      |     |    |    |    |    |     |

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



**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  |    |      | 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.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

**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 | 35 | 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  | C    |     | C  | C  | C  |    | C    | C   | D  | D  | D  | D  | D   |
|                     | 0.22μF (224)  |      | 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  |    | K    |     | D  | D  | D  | D  |     |
| 10μF (106)          |               | J    | J  | P  |    |    |      | D   | D  | G  | K  | K  |      | D   | D  | D  | K  |    |     |
| 22μF (226)          |               | P    | P  |    |    |    |      |     | K  | K  |    |    |      |     |    |    |    |    |     |
| 47μF (476)          |               |      |    |    |    |    |      | K   | K  |    |    |    |      |     | M  |    |    |    |     |
| 100μF (107)         |               |      |    |    |    |    |      | M   |    |    |    |    |      |     |    |    |    |    |     |

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

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 | 4    | 6.3 | 10 | 16 | 25 | 50   | 4 | 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  | L  |    |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 2,200pF (222) |      | L  | L  | L  |    |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 2,700pF (272) |      | L  | L  | L  |    |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 3,300pF (332) |      | L  | L  | L  |    |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 4,700pF (472) |      | L  | L  | L  |    |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 6,800pF (682) |      | L  | L  | L  | L  |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 0.010μF (103) | L    | 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  | N  | N  |      |   |     |    |    |    |    |
|                     | 0.056μF (563) | L    | L  |    |    |    |      |     | N  | N  | N  |      |   |     |    |    |    |    |
|                     | 0.068μF (683) | L    | L  |    |    |    |      |     | N  | N  | N  |      |   |     |    |    |    |    |
|                     | 0.082μF (823) | L    | L  |    |    |    |      |     | N  | N  | N  |      |   |     |    |    |    |    |
|                     | 0.10μF (104)  | L    | L  | L  | L  |    |      |     | N  | N  | N  | N    |   |     |    |    |    |    |
|                     | 0.15μF (154)  |      |    |    |    |    |      |     | N  | N  | N  | N    |   |     |    |    |    |    |
|                     | 0.22μF (224)  | L    | L  | L* |    |    |      |     | N  | N  | N  | N    | N |     | X  | X  | X  | X  |
|                     | 0.27μF (274)  |      |    |    |    |    |      |     |    |    |    |      |   |     |    | X  | X  | X  |
|                     | 0.33μF (334)  | L*   |    |    |    |    |      |     | N  | N  |    |      |   |     | X  | X  | X  | X  |
|                     | 0.39μF (394)  |      |    |    |    |    |      |     |    |    |    |      |   |     |    | 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  | X  |
|                     | 1.0μF (105)   | L*   | L* | L* |    |    |      |     | N  | N  | N  | N    |   |     | X  | X  | X  | X  |
|                     | 1.5μF (155)   |      |    |    |    |    |      |     |    |    |    |      |   |     | X  |    |    |    |
|                     | 2.2μF (225)   | L*   | L* |    |    |    |      |     | N  | N  | E  | E    |   |     | X  | X  | X  | X  |
|                     | 3.3μF (335)   |      |    |    |    |    |      |     |    |    |    |      |   |     | X  | X  |    |    |
|                     | 4.7μF (475)   |      |    |    |    |    |      |     | E  | E  | E* |      |   |     | X  | X  | X  | X  |
|                     | 6.8μF (685)   |      |    |    |    |    |      |     |    |    |    |      |   |     |    |    |    |    |
|                     | 10μF (106)    |      |    |    |    |    |      | E*  | E* | E* |    |      |   | X   | X  | X  | X  | X* |
|                     | 22μF (226)    |      |    |    |    |    |      |     |    |    |    |      |   | X*  | X* | X* |    |    |
|                     | 47μF (476)    |      |    |    |    |    |      |     |    |    |    |      |   | X*  | X* |    |    |    |

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

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

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

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

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

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

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

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

## 8. PACKAGING STYLE AND QUANTITY

| Size        | Thickness (mm)/Symbol |   | Paper tape |          | Plastic tape |          |
|-------------|-----------------------|---|------------|----------|--------------|----------|
|             |                       |   | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0201 (0603) | 0.30±0.03             | L | 15,000     | 70,000   | -            | -        |
|             | 0.30±0.05             | L | 15,000     | -        | -            | -        |
|             | 0.30±0.09             | L | 15,000     | -        | -            | -        |
| 0402 (1005) | 0.50±0.05             | N | 10,000     | 50,000   | -            | -        |
|             | 0.50+0.02/-0.05       | Q | 10,000     | 50,000   | -            | -        |
|             | 0.50±0.20             | E | 10,000     | -        | -            | -        |
| 0603 (1608) | 0.50±0.10             | H | 4,000      | -        | -            | -        |
|             | 0.80±0.07             | S | 4,000      | 15,000   | -            | -        |
|             | 0.80+0.15/-0.10       | X | 4,000      | 15,000   | -            | -        |
| 0805 (2012) | 0.50±0.10             | H | 4,000      | 15,000   | -            | -        |
|             | 0.60±0.10             | A | 4,000      | 15,000   | -            | -        |
|             | 0.80±0.10             | B | 4,000      | 15,000   | -            | -        |
|             | 0.85±0.10             | T | 4,000      | 15,000   | -            | -        |
|             | 1.25±0.10             | D | -          | -        | 3,000        | 10,000   |
|             | 1.25±0.20             | I | -          | -        | 3,000        | 10,000   |
| 1206 (3216) | 0.80±0.10             | B | 4,000      | 15,000   | -            | -        |
|             | 0.85±0.10             | T | 4,000      | 15,000   | -            | -        |
|             | 0.95±0.10             | C | -          | -        | 3,000        | 10,000   |
|             | 1.15±0.15             | J | -          | -        | 3,000        | 10,000   |
|             | 1.25±0.10             | D | -          | -        | 3,000        | 10,000   |
|             | 1.60±0.20             | G | -          | -        | 2,000        | 10,000   |
|             | 1.60+0.30/-0.10       | P | -          | -        | 2,000        | 9,000    |
| 1210 (3225) | 0.85±0.10             | T | -          | -        | 3,000        | 10,000   |
|             | 0.95±0.10             | C | -          | -        | 3,000        | 10,000   |
|             | 1.25±0.10             | D | -          | -        | 3,000        | 10,000   |
|             | 1.60±0.20             | G | -          | -        | 2,000        | -        |
|             | 2.00±0.20             | K | -          | -        | 1,000        | 6,000    |
|             | 2.50±0.30             | M | -          | -        | 1,000        | 6,000    |
| 1808 (4520) | 1.25±0.10             | D | -          | -        | 2,000        | 10,000   |
|             | 1.10±0.15             | F | -          | -        | 2,000        | 10,000   |
|             | 1.60±0.20             | G | -          | -        | 2,000        | 8,000    |
|             | 2.00±0.20             | K | -          | -        | 1,000        | 6,000    |
| 1812 (4532) | 1.25±0.10             | D | -          | -        | 1,000        | 5,000    |
|             | 1.60±0.20             | G | -          | -        | 1,000        | -        |
|             | 2.00±0.20             | K | -          | -        | 1,000        | -        |
|             | 2.50±0.30             | M | -          | -        | 500          | 3,000    |
|             | 2.80±0.30             | U | -          | -        | 500          | -        |

Unit: pieces

### 9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.   | Item  | Test Condition  | Requirements  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|---|---|---|---|---------------|-----------------------|---------------------|---|--|--|---|--|---|---|-------|-----------------------------|-----------------------|------------------------------|---------------|---|---|-----------------------------|--|--|--|---|--|---|-----|--------|------|--|------|-----------------------------|-------|--|-----|--------|------|---|-------|---|-------|--|-----|------|-------|--|------|-------|-------|---|-------|--------------|----|-------|-----|-----|------------|--------|---------------------|--|-------|------|------|--|---------|--------------|-----|------|-----|-----|-----|------|------|---|------|---|---------|-------------------------------|---------------|------|---------|---------------|---------------|------|---------|--|-----|---------|-------|---------------|------|-------|-----|-----|
| 1.  | Visual and Mechanical                       | ---   | * No remarkable defect.<br>* Dimensions to conform to individual specification sheet.   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 2.  | Capacitance                                 | Class I: (NP0)<br>≤ 1000pF, 1.0±0.2Vrms · 1MHz±10%<br>> 1000pF, 1.0±0.2Vrms · 1KHz±10%<br>Class II: (X7R, X7E, X6S, X5R, X7S, Y5V)<br>C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% **<br>C > 10μF, 0.5±0.2Vrms · 120Hz±20%  | * Shall not exceed the limits given in the detailed spec.<br>NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C<br>X7R, X5R, X6S, X7S:  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 3.  | Q/ D.F.<br>(Dissipation Factor)             | ** Test condition: 0.5±0.2Vrms · 1KHz±10%<br>X7R:<br>0805=106(6.3V), 0603/475(6.3V)<br>X5R:<br>01R5 ≥ 103, 0201 ≥ 224 (6.3V, 10V, 16V) #1,<br>0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V),<br>0603=106 (6.3V, 10V),<br>TT 18X ≥ 475(10V) , TT 15X series<br>X6S:<br>0201 ≥ 104 (6.3V, 10V), 0402 ≥ 225 (6.3V),<br>0402/475 (10V), 0603/106 (6.3V),<br>X7S:<br>0402/225(6.3V)<br><br>#1 Excluding<br>X5R/0201/105(6.3V);225(10V),<br>(1.0±0.2Vrms · 1KHz±10%)<br><br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set<br>for 24±2 hrs at room temp. | <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0805 &gt; 0.1μF; 0603 ≥ 0.068μF; 1206 &gt; 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 10%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td>35V</td> <td>≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series</td> </tr> <tr> <td>10V</td> <td>≤ 5%</td> <td>≤ 10%</td> <td>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table><br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥ 50V</td> <td rowspan="2">≤ 5%</td> <td>≤ 7%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td>35V</td> <td>≤ 7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 5%</td> <td>≤ 7%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>16V (C&lt;1.0μF)</td> <td>≤ 7%</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>16V (C&gt;1.0μF)</td> <td>≤ 9%</td> <td>≤ 12.5%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series</td> </tr> <tr> <td>10V</td> <td>≤ 12.5%</td> <td>≤ 20%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol.    | D.F. ≤                | Exception of D.F. ≤ |   | ≥ 100V   | ≤ 2.5%                                       | ≤ 3%  | 1206 ≥ 0.47μF  | ≤ 5%  | 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series | ≤ 10% | 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V                   | ≤ 2.5%                       | ≤ 3%          | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 5%  | 0201 ≥ 0.01μF; 1210 ≥ 4.7μF | ≤ 10%  | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series | 35V  | ≤ 3.5%  | ≤ 10%                                      | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V | ≤ 3.5% | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 7% | 0603 ≥ 0.33μF; 1206 ≥ 4.7μF | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series | 16V | ≤ 3.5% | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | ≤ 10% | 0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series | ≤ 15% | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series | 10V | ≤ 5% | ≤ 10% | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5 | 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% | --- | --- | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥ 50V | ≤ 5% | ≤ 7% | 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series | ≤ 12.5% | 1210 ≥ 6.8μF | 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; TT series | ≤ 12.5% | 0402 ≥ 0.068μF; 0603 ≥ 0.68μF | 16V (C<1.0μF) | ≤ 7% | ≤ 12.5% | 0402 ≥ 0.22μF | 16V (C>1.0μF) | ≤ 9% | ≤ 12.5% | 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series | 10V | ≤ 12.5% | ≤ 20% | 0402 ≥ 0.47μF | 6.3V | ≤ 20% | --- | --- |
| Rated vol.  | D.F. ≤                                      | Exception of D.F. ≤   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| ≥ 100V  | ≤ 2.5%                                      | ≤ 3%  | 1206 ≥ 0.47μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 5%  | 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 10%   | 0805 > 0.22μF; 1210 ≥ 3.3μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 50V   | ≤ 2.5%                                      | ≤ 3%  | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 5%  | 0201 ≥ 0.01μF; 1210 ≥ 4.7μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 10%   | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 35V   | ≤ 3.5%                                      | ≤ 10%   | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 25V   | ≤ 3.5%                                      | ≤ 5%  | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 7%  | 0603 ≥ 0.33μF; 1206 ≥ 4.7μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 10%   | 0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 16V   | ≤ 3.5%                                      | ≤ 5%  | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 10%   | 0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 15%   | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 10V   | ≤ 5%  | ≤ 10%   | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 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%                                       | ---   | ---   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| Rated vol.  | D.F. ≤                                      | Exception of D.F. ≤   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| ≥ 50V   | ≤ 5%  | ≤ 7%  | 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 12.5%   | 1210 ≥ 6.8μF  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 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; TT series   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
|   |   | ≤ 12.5%   | 0402 ≥ 0.068μF; 0603 ≥ 0.68μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 16V (C<1.0μF)   | ≤ 7%  | ≤ 12.5%   | 0402 ≥ 0.22μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 16V (C>1.0μF)   | ≤ 9%  | ≤ 12.5%   | 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series  |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 10V   | ≤ 12.5%                                     | ≤ 20%   | 0402 ≥ 0.47μF   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 6.3V  | ≤ 20%                                       | ---   | ---   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 4.  | Dielectric Strength                         | To apply voltage (≤100V) 250%.<br>Duration: 1 to 5 sec.<br>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. 120sec.<br><br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set<br>for 24±2 hrs at room temp.  | <p>10GΩ or RxC ≥ 500Ω-F whichever is smaller.<br/>Class II (X7R, X7E, X5R, X6S, X7S, Y5V):</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R</td> <td rowspan="6">10GΩ or RxC ≥ 100 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; TT series; Size ≥ 1812</td> <td></td> </tr> <tr> <td>Rated voltage</td> <td>Insulation Resistance</td> </tr> <tr> <td>All X6S items, All X7S items</td> <td rowspan="7">RxC ≥ 50 Ω-F.</td> </tr> <tr> <td>100V: 1210 ≥ 3.3μF</td> </tr> <tr> <td>50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF;</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF</td> </tr> <tr> <td>16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF</td> </tr> <tr> <td>10V: 0201 &gt; 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT 21 &gt; 4.7μF</td> </tr> <tr> <td>6.3V: 0201 ≥ 0.1μF; 0603 &gt; 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT 15 &gt; 1.0μF</td> </tr> <tr> <td>4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF</td> </tr> </tbody> </table>   | Rated voltage | Insulation Resistance | 100V: All X7R       | 10GΩ or RxC ≥ 100 Ω-F whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V; 4V; TT series; Size ≥ 1812                                  |       | Rated voltage               | Insulation Resistance | All X6S items, All X7S items | RxC ≥ 50 Ω-F. | 100V: 1210 ≥ 3.3μF                                      | 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF | 35V: 0603 ≥ 1μF;            | 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF | 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF                                    | 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT 21 > 4.7μF | 6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT 15 > 1.0μF | 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| Rated voltage   | Insulation Resistance                       |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 100V: All X7R   | 10GΩ or RxC ≥ 100 Ω-F whichever is smaller. |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF                  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF                   |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF    |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 6.3V; 4V; TT series; Size ≥ 1812  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| Rated voltage   | Insulation Resistance                       |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| All X6S items, All X7S items  | RxC ≥ 50 Ω-F.                               |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 100V: 1210 ≥ 3.3μF  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF                               |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 35V: 0603 ≥ 1μF;  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF                  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF   |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT 21 > 4.7μF                  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT 15 > 1.0μF               |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |
| 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF  |   |   |   |               |                       |                     |   |  |  |   |  |   |   |       |                             |                       |                              |               |   |   |                             |  |  |  |   |  |   |     |        |      |  |      |                             |       |  |     |        |      |   |       |   |       |  |     |      |       |  |      |       |       |   |       |              |    |       |     |     |            |        |                     |  |       |      |      |  |         |              |     |      |     |     |     |      |      |   |      |   |         |                               |               |      |         |               |               |      |         |  |     |         |       |               |      |       |     |     |

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

| No.  | Item                                     | Test Condition  | Requirements  |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|--|--|---|---|------------|---|---------------------|-------|-----|------------------|---|--------------------------------|------|-----|--|--------------------------------|--|-----|-----|--|-----|-----|--|--------------------------------|---|-----|-----|-------------------|---|--|-----|-------|---|--|--|------|------|------|----|------|-----|------------|--------|---------------------|------|-------|---|------------------|-----|-----|------|-----|-----|-------|---|---|-----|---------------|------|------------------------------------|---------------|--------|-------------------|-----|------|--|--------------|------|------|-----|---------------|-----------------------|----------------------------|--|---|--|--|--|---|---|
| 13.  | Humidity (Damp Heat) Steady State        | *Test temp.: 40±2°C   | * No remarkable damage.<br>* Cap change:<br>NP0: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br>TT series & C≥1μF, within ±25%<br>**10V: 0603 ≥4.7μF; 0402 ≥1μF; 0201 ≥0.1μF, within ±25%;<br>Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%<br>* Q/D.F. value:<br>NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C<br>Less than 10pF Q≥200+10C<br>X7R, X5R, X6S, X7S:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td rowspan="3">≤3%</td> <td>≤6% 1206 ≥0.47μF</td> </tr> <tr> <td>≤7.5% 0805 &gt;0.1μF; 0603 ≥0.068μF; 1206 &gt;1μF; 1210 ≥2.2μF; TT series</td> </tr> <tr> <td>≤20% 0805 &gt;0.22μF; 1210 ≥3.3μF</td> </tr> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF</td> </tr> <tr> <td>≤10% 0201 ≥0.01μF; 1210 ≥4.7μF</td> </tr> <tr> <td>≤20% 0402 ≥0.012μF; 0603 &gt;0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series</td> </tr> <tr> <td>35V</td> <td>≤5%</td> <td>≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤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% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤10% 0402 ≥0.47μF</td> </tr> <tr> <td>≤15% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF</td> </tr> <tr> <td>0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤7.5%</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; 01R5</td> </tr> <tr> <td>≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30%</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> </tbody> </table><br>Y5V:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤7.5%</td> <td>≤10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF</td> </tr> <tr> <td>≤20% 1210 ≥6.8μF</td> </tr> <tr> <td>---</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤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>---</td> </tr> <tr> <td>16V (C&lt;1.0μF)</td> <td>≤10%</td> <td>≤12.5% 0402 ≥0.068μF; 0603 ≥0.68μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>≤12.5%</td> <td>≤20% 0402 ≥0.22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤20%</td> <td>≤30% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;</td> </tr> <tr> <td>0402 ≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> </tr> </tbody> </table><br>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, X7S, Y5V)<br><table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥3.3μF</td> <td rowspan="7">1GΩ or RxC ≥10 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt;0.01μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF</td> </tr> <tr> <td>35V: 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td>25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF</td> </tr> <tr> <td>16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF</td> </tr> <tr> <td>10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF</td> </tr> <tr> <td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥1812</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤  | Exception of D.F. ≤ | ≥100V | ≤3% | ≤6% 1206 ≥0.47μF | ≤7.5% 0805 >0.1μF; 0603 ≥0.068μF; 1206 >1μF; 1210 ≥2.2μF; TT series | ≤20% 0805 >0.22μF; 1210 ≥3.3μF | ≥50V | ≤3% | ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF | ≤10% 0201 ≥0.01μF; 1210 ≥4.7μF | ≤20% 0402 ≥0.012μF; 0603 >0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series | 35V | ≤5% | ≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF | 25V | ≤5% | ≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF | ≤14% 0603 ≥0.33μF; 1206 ≥4.7μF | ≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series | 16V | ≤5% | ≤10% 0402 ≥0.47μF | ≤15% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF | 0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series | 10V | ≤7.5% | ≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF | ≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5 | ≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series | 6.3V | ≤15% | ≤30% | 4V | ≤20% | --- | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥50V | ≤7.5% | ≤10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF | ≤20% 1210 ≥6.8μF | --- | 35V | ≤10% | --- | 25V | ≤7.5% | ≤10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF | ≤15% 0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF | --- | 16V (C<1.0μF) | ≤10% | ≤12.5% 0402 ≥0.068μF; 0603 ≥0.68μF | 16V (C≥1.0μF) | ≤12.5% | ≤20% 0402 ≥0.22μF | 10V | ≤20% | ≤30% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF; | 0402 ≥0.47μF | 6.3V | ≤30% | --- | Rated voltage | Insulation Resistance | 100V: All X7R; 1210 ≥3.3μF | 1GΩ or RxC ≥10 Ω-F whichever is smaller. | 50V: 0402 >0.01μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF | 35V: 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF | 25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF | 16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF | 10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF | 6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥1812 |
|  |  | Rated vol.  |   | D.F. ≤     | Exception of D.F. ≤   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ≥100V   |   | ≤3%        | ≤6% 1206 ≥0.47μF  |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  |   |   |            | ≤7.5% 0805 >0.1μF; 0603 ≥0.068μF; 1206 >1μF; 1210 ≥2.2μF; TT series                           |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  |   |   |            | ≤20% 0805 >0.22μF; 1210 ≥3.3μF  |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ≥50V  |   | ≤3%        | ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF                                      |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  |   |   |            | ≤10% 0201 ≥0.01μF; 1210 ≥4.7μF  |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  |   |   |            | ≤20% 0402 ≥0.012μF; 0603 >0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series                |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | 35V   |   | ≤5%        | ≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF  |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | 25V   |   | ≤5%        | ≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF  |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  |   |   |            | ≤14% 0603 ≥0.33μF; 1206 ≥4.7μF  |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  |   |   |            | ≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | 16V   |   | ≤5%        | ≤10% 0402 ≥0.47μF   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| ≤15% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF  |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 10V  | ≤7.5%                                    | ≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5  |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series                |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 6.3V   | ≤15%                                     | ≤30%  |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 4V   | ≤20%                                     | ---   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| Rated vol.   | D.F. ≤                                   | Exception of D.F. ≤   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| ≥50V   | ≤7.5%                                    | ≤10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ≤20% 1210 ≥6.8μF  |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ---   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 35V  | ≤10%                                     | ---   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 25V  | ≤7.5%                                    | ≤10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF                                   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ≤15% 0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | ---   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 16V (C<1.0μF)  | ≤10%                                     | ≤12.5% 0402 ≥0.068μF; 0603 ≥0.68μF  |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 16V (C≥1.0μF)  | ≤12.5%                                   | ≤20% 0402 ≥0.22μF   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 10V  | ≤20%                                     | ≤30% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;                                      |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
|  |  | 0402 ≥0.47μF  |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 6.3V   | ≤30%                                     | ---   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| Rated voltage  | Insulation Resistance                    |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 100V: All X7R; 1210 ≥3.3μF   | 1GΩ or RxC ≥10 Ω-F whichever is smaller. |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 50V: 0402 >0.01μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF  |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 35V: 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF   |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF                               |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF                                 |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF                              |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |
| 6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥1812  |  |   |   |            |   |                     |       |     |                  |   |                                |      |     |  |                                |  |     |     |  |     |     |  |                                |   |     |     |                   |   |  |     |       |   |  |  |      |      |      |    |      |     |            |        |                     |      |       |   |                  |     |     |      |     |     |       |   |   |     |               |      |                                    |               |        |                   |     |      |  |              |      |      |     |               |                       |                            |  |   |  |  |  |   |   |

| No   | Item   | Test Condition   | Requirements  |  |
|--|--|--|---|--|
| 14   | Humidity (Damp Heat) Load  | *Test temp. : 40±2°C   | * No remarkable damage.<br>Cap change:<br>NP0: ±7.5% or 0.75pF whichever is larger.<br>X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br>TT series & C≥1μF, within ±25%<br>**10V: 0603 ≥4.7μF; 0402 ≥1μF; 0201 ≥0.1μF, within ±25%;<br>Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%<br>Q/D.F. value:<br>NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C<br>X7R, X5R, X6S, X7S: |  |
|  |  | *Humidity : 90-95%RH   |   |  |
|  |  | *Test time : 500+24/-0 hrs.  |   |  |
|  |  | *To apply voltage :<br>Rated voltage (MAX. 500V)   |   |  |
|  |  | *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp |   |  |
|  |  | * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.   |   |  |
|  |  | <b>Rated vol. ≤ D.F. ≤ Exception of D.F. ≤</b>   |   |  |
|  |  | ≥100V ≤3%  |   | ≤6% 1206 ≥0.47μF<br>≤7.5% 0805 > 0.1μF; 0603 ≥0.068μF; 1206 > 1μF; 1210 ≥2.2μF; TT series<br>≤20% 0805 > 0.22μF; 1210 ≥3.3μF   |
|  |  | ≥50V ≤3%   |   | ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF<br>≤10% 0201 ≥0.01μF; 1210 ≥4.7μF<br>≤20% 0402 ≥0.012μF; 0603 > 0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series    |
|  |  | 35V ≤5%  |   | ≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF<br>≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF   |
|  |  | 25V ≤5%  |   | ≤14% 0603 ≥0.33μF; 1206 ≥4.7μF<br>≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series<br>≤20% 0402 ≥0.47μF                             |
|  |  | 16V ≤5%  |   | ≤10% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF<br>≤15% 0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series |
|  |  | 10V ≤7.5%  |   | ≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF<br>≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5                          |
|  |  | 6.3V ≤15%  |   | ≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series   |
|  |  | 4V ≤20%  |   | ---  |
| <b>Y5V:</b>  |  |  |   |  |
| <b>Rated vol. D.F. ≤ Exception of D.F. ≤</b>   |  |  |   |  |
| ≥50V ≤7.5%   | ≤10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF<br>≤20% 1210 ≥6.8μF  |  |   |  |
| 35V ≤10%   | ---  |  |   |  |
| 25V ≤7.5%  | ≤10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF<br>≤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<br>≤20% 0402 ≥0.22μF  |  |   |  |
| 16V (C≥1.0μF) ≤12.5%   | ≤20% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;   |  |   |  |
| 10V ≤20%   | ≤30% 0402 ≥0.47μF  |  |   |  |
| 6.3V ≤30%  | ---  |  |   |  |
| *I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, X7S, Y5V) |  |  |   |  |
| <b>Rated voltage</b>   |  | <b>Insulation Resistance</b>   |   |  |
| 100V: All X7R; 1210 ≥3.3μF   |  | 500MΩ or RxC ≥5 Ω-F whichever is smaller.  |   |  |
| 50V: 0402 > 0.01μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF                       |  |  |   |  |
| 35V: 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF                                     |  |  |   |  |
| 25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF         |  |  |   |  |
| 16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF           |  |  |   |  |
| 10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF        |  |  |   |  |
| 6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥1812                                    |  |  |   |  |



| No   | Item                                      | Test Condition   | Requirements   |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|--|---|--|--|------------------------------------|---|--|--|--|--|---|--|--------------------------|-------------|--------------------|---|-----------|--|-------|---------------------|---------------------|-----------|-------------|-----------------------------------|-------|----------|--|------|-----------------|---------------------|---|------------|-----------------------------------|--------------------|------------------------|--|--------|--|-------------------|----------------------|----------|---|--------|----------------------|--|-------------------------|------------------------------------|---------------|-----------------------|----------|-----------------------------------|---------|--|--|-------------|--------------------|-----------|-----------|----------|---------------------|------|-------------|--|-----------|------|-------|-----------|----------------------|---|-----------|-----------|---|------|-----|-----------|-----------|------------|---|------|----------|---|------|-------------|-------|----------|------------|---|------|----------|-----------|------|-----|------|----------|----------|-----|-----|-----|-----|
| 15.  | High Temperature Load (Endurance)         | Test temp. :<br>NP0, X7R/X7E/X7S: 125±3°C<br>X6S: 105±3°C<br>X5R, Y5V: 85±3°C<br>To apply voltage:<br>(1) ≤6.3V or C ≥ 10µF or TT series: 150% of rated voltage.<br>(2) 10V ≤ Ur < 500V: 200% of rated voltage.<br>(3) 500V: 150% of rated voltage.<br>(4) Ur ≥ 630V: 120% of rated voltage.<br>(5) 100% of rated voltage for below range.   | * No remarkable damage.<br>Cap change:<br>NP0: ±3.0% or ±0.3pF whichever is larger<br>X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C ≥ 1µF, within ±25%<br>**10V: 0603 ≥ 4.7µF; 0402 ≥ 1µF; 0201 ≥ 0.1µF, within ±25%;<br>Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%<br>Q/D.F. value:<br>NP0: More than 30pF, Q ≥ 350<br>10pF ≤ C < 30pF, Q ≥ 275 + 2.5C<br>Less than 10pF, Q ≥ 200 + 10C |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> <th>Rated V.D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X6S</td> <td>≤ 10V</td> <td>C ≥ 0.1µF</td> <td rowspan="2">≥ 100V ≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47µF</td> </tr> <tr> <td>≥ 16V</td> <td>C &gt; 0.1µF</td> <td>≤ 7.5% 0805 &gt; 0.1µF, 0603 ≥ 0.068µF, 1206 &gt; 1µF; 1210 ≥ 2.2µF; TT series</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X6S/X7S/Y5V</td> <td>6.3V, 10V, 16V, 25V</td> <td>C ≥ 1.0µF</td> <td rowspan="2">≥ 50V ≤ 3%</td> <td>≤ 20% 0805 &gt; 0.22µF; 1210 ≥ 3.3µF</td> </tr> <tr> <td>4V</td> <td>C ≥ 22µF</td> <td>≤ 6% 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6S/X7S</td> <td>6.3V, 10V, 25V, 35V</td> <td>C ≥ 4.7µF<br/>C ≥ 1.0µF</td> <td rowspan="2">≥ 50V ≤ 3%</td> <td>≤ 10% 0201 ≥ 0.01µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>4V</td> <td>C ≥ 47µF</td> <td>≤ 20% 0402 ≥ 0.012µF; 0603 ≥ 0.1µF; 0805 ≥ 1µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6S/X7S</td> <td>4V, 6.3V, 10V-50V</td> <td>C ≥ 22µF<br/>C ≥ 10µF</td> <td rowspan="2">35V ≤ 5%</td> <td>≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>≤ 6.3V</td> <td>C ≥ 47µF</td> <td>≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X5R/X7R/X6S<br/>NP0</td> <td>≤ 6.3V, 3000V</td> <td>C ≥ 47µF<br/>C ≥ 1.5pF</td> <td rowspan="2">25V ≤ 5%</td> <td>≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF</td> </tr> <tr> <td>16V</td> <td>C ≥ 47µF</td> <td>≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF; TT series</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X5R/X7R/X6S<br/>X7R</td> <td>16V, 100V</td> <td>C ≥ 3.3µF</td> <td rowspan="2">16V ≤ 5%</td> <td>≤ 20% 0402 ≥ 0.47µF</td> </tr> <tr> <td>6.3V</td> <td>C &gt; 1.0µF</td> <td>≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td rowspan="2">TT15</td> <td rowspan="2">X5R</td> <td>6.3V</td> <td>C &gt; 1.0µF</td> <td rowspan="2">16V ≤ 5%</td> <td>≤ 15% 0201 ≥ 0.01µF (0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series</td> </tr> <tr> <td>6.3V, 10V</td> <td>C ≥ 2.2µF</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 rowspan="2">TT18</td> <td rowspan="2">Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 2.2µF</td> <td rowspan="2">10V ≤ 7.5%</td> <td>≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5</td> </tr> <tr> <td>6.3V</td> <td>C ≥ 10µF</td> <td>≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5</td> </tr> <tr> <td rowspan="2">TT21</td> <td rowspan="2">X5R/X7R/X6S</td> <td>≤ 10V</td> <td>C ≥ 10µF</td> <td rowspan="2">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>6.3V</td> <td>C ≥ 22µF</td> <td>≤ 20% ---</td> </tr> <tr> <td rowspan="2">TT31</td> <td rowspan="2">Y5V</td> <td>6.3V</td> <td>C ≥ 22µF</td> <td rowspan="2">4V ≤ 20%</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Size   | Dielectric                         | Rated voltage   | Capacitance range  | Rated V.D.F. ≤   | Exception of D.F. ≤  | 0201   | X5R/X7R/X6S   | ≤ 10V  | C ≥ 0.1µF                | ≥ 100V ≤ 3% | ≤ 6% 1206 ≥ 0.47µF | ≥ 16V                                     | C > 0.1µF | ≤ 7.5% 0805 > 0.1µF, 0603 ≥ 0.068µF, 1206 > 1µF; 1210 ≥ 2.2µF; TT series | 0402  | X5R/X7R/X6S/X7S/Y5V | 6.3V, 10V, 16V, 25V | C ≥ 1.0µF | ≥ 50V ≤ 3%  | ≤ 20% 0805 > 0.22µF; 1210 ≥ 3.3µF | 4V    | C ≥ 22µF | ≤ 6% 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF | 0603 | X5R/X7R/X6S/X7S | 6.3V, 10V, 25V, 35V | C ≥ 4.7µF<br>C ≥ 1.0µF  | ≥ 50V ≤ 3% | ≤ 10% 0201 ≥ 0.01µF; 1210 ≥ 4.7µF | 4V                 | C ≥ 47µF               | ≤ 20% 0402 ≥ 0.012µF; 0603 ≥ 0.1µF; 0805 ≥ 1µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series | 0805   | X5R/X7R/X6S/X7S  | 4V, 6.3V, 10V-50V | C ≥ 22µF<br>C ≥ 10µF | 35V ≤ 5% | ≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF | ≤ 6.3V | C ≥ 47µF             | ≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF | 1206                    | X5R/X7R/X6S<br>NP0                 | ≤ 6.3V, 3000V | C ≥ 47µF<br>C ≥ 1.5pF | 25V ≤ 5% | ≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF | 16V     | C ≥ 47µF   | ≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF; TT series | 1210        | X5R/X7R/X6S<br>X7R | 16V, 100V | C ≥ 3.3µF | 16V ≤ 5% | ≤ 20% 0402 ≥ 0.47µF | 6.3V | C > 1.0µF   | ≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF | TT15      | X5R  | 6.3V  | C > 1.0µF | 16V ≤ 5%             | ≤ 15% 0201 ≥ 0.01µF (0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series | 6.3V, 10V | C ≥ 2.2µF | ≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF (0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF | TT18 | Y5V | 6.3V, 10V | C ≥ 2.2µF | 10V ≤ 7.5% | ≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | 6.3V | C ≥ 10µF | ≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5 | TT21 | X5R/X7R/X6S | ≤ 10V | C ≥ 10µF | 6.3V ≤ 15% | ≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series | 6.3V | C ≥ 22µF | ≤ 20% --- | TT31 | Y5V | 6.3V | C ≥ 22µF | 4V ≤ 20% | --- | --- | --- | --- |
|  |   | Size   | Dielectric   | Rated voltage                      | Capacitance range   | Rated V.D.F. ≤   | Exception of D.F. ≤  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 0201   | X5R/X7R/X6S  | ≤ 10V                              | C ≥ 0.1µF   | ≥ 100V ≤ 3%  | ≤ 6% 1206 ≥ 0.47µF   |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  | ≥ 16V                              | C > 0.1µF   |  | ≤ 7.5% 0805 > 0.1µF, 0603 ≥ 0.068µF, 1206 > 1µF; 1210 ≥ 2.2µF; TT series                             |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 0402   | X5R/X7R/X6S/X7S/Y5V  | 6.3V, 10V, 16V, 25V                | C ≥ 1.0µF   | ≥ 50V ≤ 3%   | ≤ 20% 0805 > 0.22µF; 1210 ≥ 3.3µF  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  | 4V                                 | C ≥ 22µF  |  | ≤ 6% 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF   |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 0603   | X5R/X7R/X6S/X7S  | 6.3V, 10V, 25V, 35V                | C ≥ 4.7µF<br>C ≥ 1.0µF  | ≥ 50V ≤ 3%   | ≤ 10% 0201 ≥ 0.01µF; 1210 ≥ 4.7µF  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  | 4V                                 | C ≥ 47µF  |  | ≤ 20% 0402 ≥ 0.012µF; 0603 ≥ 0.1µF; 0805 ≥ 1µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series                 |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 0805   | X5R/X7R/X6S/X7S  | 4V, 6.3V, 10V-50V                  | C ≥ 22µF<br>C ≥ 10µF  | 35V ≤ 5%   | ≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  | ≤ 6.3V                             | C ≥ 47µF  |  | ≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF   |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 1206   | X5R/X7R/X6S<br>NP0   | ≤ 6.3V, 3000V                      | C ≥ 47µF<br>C ≥ 1.5pF   | 25V ≤ 5%   | ≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  | 16V                                | C ≥ 47µF  |  | ≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF; TT series |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 1210   | X5R/X7R/X6S<br>X7R   | 16V, 100V                          | C ≥ 3.3µF   | 16V ≤ 5%   | ≤ 20% 0402 ≥ 0.47µF  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  | 6.3V                               | C > 1.0µF   |  | ≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF                                       |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| TT15   | X5R                                       | 6.3V   | C > 1.0µF  | 16V ≤ 5%                           | ≤ 15% 0201 ≥ 0.01µF (0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 6.3V, 10V  | C ≥ 2.2µF  |                                    | ≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF (0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF             |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| TT18   | Y5V                                       | 6.3V, 10V  | C ≥ 2.2µF  | 10V ≤ 7.5%                         | ≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 6.3V   | C ≥ 10µF   |                                    | ≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| TT21   | X5R/X7R/X6S                               | ≤ 10V  | C ≥ 10µF   | 6.3V ≤ 15%                         | ≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series                             |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 6.3V   | C ≥ 22µF   |                                    | ≤ 20% ---   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| TT31   | Y5V                                       | 6.3V   | C ≥ 22µF   | 4V ≤ 20%                           | ---   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | ---  | ---  |                                    | ---   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| **1WV items must follow de-rating conditions   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| (6) 150% of rated voltage for below range.   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X6S<br/>X7R</td> <td>16V/25V, 16V</td> <td>C ≥ 0.1µF<br/>C ≥ 0.022µF</td> <td rowspan="2">Y5V: ≥ 50V</td> <td>≤ 10%</td> <td>0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF</td> </tr> <tr> <td>50V</td> <td>C ≥ 0.1µF</td> <td>≤ 20%</td> <td>1210 ≥ 6.8µF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">S<br/>Y5V</td> <td>10~25V, 16V</td> <td>C ≥ 0.22µF<br/>C ≥ 0.47µF</td> <td rowspan="2">≥ 35V</td> <td>≤ 10%</td> <td>---</td> </tr> <tr> <td>50V</td> <td>C &gt; 0.1µF</td> <td>≤ 7.5%</td> <td>0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6S/X7S<br/>Y5V</td> <td>10V, 16V, 50V, 16V</td> <td>C ≥ 1.0µF<br/>C ≥ 2.2µF</td> <td rowspan="2">25V</td> <td>≤ 7.5%</td> <td>0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF</td> </tr> <tr> <td>10~50V</td> <td>C ≥ 4.7µF</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.068µF; 0603 ≥ 0.68µF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6S/X7S<br/>S</td> <td>50V, 100V</td> <td>C ≥ 2.2µF<br/>C ≥ 0.47µF</td> <td rowspan="2">16V (C &lt; 1.0µF)<br/>16V (C ≥ 1.0µF)</td> <td>≤ 10%</td> <td>0402 ≥ 0.22µF</td> </tr> <tr> <td>16V</td> <td>C ≥ 4.7µF</td> <td>≤ 12.5%</td> <td>0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF;</td> </tr> <tr> <td>1206</td> <td>X5R/X7R/X6S</td> <td>100V</td> <td>C ≥ 1.0µF</td> <td>10V</td> <td>≤ 20%</td> <td>0402 ≥ 0.47µF</td> </tr> <tr> <td>1210</td> <td>X5R/X7R/X6S</td> <td>50V~100V</td> <td>C ≥ 2.2µF</td> <td>6.3V</td> <td>≤ 30%</td> <td>---</td> </tr> <tr> <td>1825<br/>2220<br/>2225</td> <td>X7R</td> <td>100V~250V</td> <td>C ≥ 1.0µF</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> |   | Size   | Dielectric   | Rated voltage                      | Capacitance range   | Rated vol.   | D.F. ≤   | Exception of D.F. ≤  | 0201   | X5R/X7R/X6S<br>X7R  | 16V/25V, 16V   | C ≥ 0.1µF<br>C ≥ 0.022µF | Y5V: ≥ 50V  | ≤ 10%              | 0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF | 50V       | C ≥ 0.1µF  | ≤ 20% | 1210 ≥ 6.8µF        | 0402                | S<br>Y5V  | 10~25V, 16V | C ≥ 0.22µF<br>C ≥ 0.47µF          | ≥ 35V | ≤ 10%    | ---  | 50V  | C > 0.1µF       | ≤ 7.5%              | 0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF | 0603       | X5R/X7R/X6S/X7S<br>Y5V            | 10V, 16V, 50V, 16V | C ≥ 1.0µF<br>C ≥ 2.2µF | 25V  | ≤ 7.5% | 0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF | 10~50V            | C ≥ 4.7µF            | ≤ 12.5%  | 0402 ≥ 0.068µF; 0603 ≥ 0.68µF                             | 0805   | X5R/X7R/X6S/X7S<br>S | 50V, 100V                                    | C ≥ 2.2µF<br>C ≥ 0.47µF | 16V (C < 1.0µF)<br>16V (C ≥ 1.0µF) | ≤ 10%         | 0402 ≥ 0.22µF         | 16V      | C ≥ 4.7µF                         | ≤ 12.5% | 0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF; | 1206   | X5R/X7R/X6S | 100V               | C ≥ 1.0µF | 10V       | ≤ 20%    | 0402 ≥ 0.47µF       | 1210 | X5R/X7R/X6S | 50V~100V   | C ≥ 2.2µF | 6.3V | ≤ 30% | ---       | 1825<br>2220<br>2225 | X7R   | 100V~250V | C ≥ 1.0µF |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| Size   | Dielectric                                | Rated voltage  | Capacitance range  | Rated vol.                         | D.F. ≤  | Exception of D.F. ≤  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 0201   | X5R/X7R/X6S<br>X7R                        | 16V/25V, 16V   | C ≥ 0.1µF<br>C ≥ 0.022µF   | Y5V: ≥ 50V                         | ≤ 10%   | 0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF                              |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 50V  | C ≥ 0.1µF  |                                    | ≤ 20%   | 1210 ≥ 6.8µF   |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 0402   | S<br>Y5V                                  | 10~25V, 16V  | C ≥ 0.22µF<br>C ≥ 0.47µF   | ≥ 35V                              | ≤ 10%   | ---  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 50V  | C > 0.1µF  |                                    | ≤ 7.5%  | 0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 0603   | X5R/X7R/X6S/X7S<br>Y5V                    | 10V, 16V, 50V, 16V   | C ≥ 1.0µF<br>C ≥ 2.2µF   | 25V                                | ≤ 7.5%  | 0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF               |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 10~50V   | C ≥ 4.7µF  |                                    | ≤ 12.5%   | 0402 ≥ 0.068µF; 0603 ≥ 0.68µF  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 0805   | X5R/X7R/X6S/X7S<br>S                      | 50V, 100V  | C ≥ 2.2µF<br>C ≥ 0.47µF  | 16V (C < 1.0µF)<br>16V (C ≥ 1.0µF) | ≤ 10%   | 0402 ≥ 0.22µF  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   | 16V  | C ≥ 4.7µF  |                                    | ≤ 12.5%   | 0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF;     |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 1206   | X5R/X7R/X6S                               | 100V   | C ≥ 1.0µF  | 10V                                | ≤ 20%   | 0402 ≥ 0.47µF  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 1210   | X5R/X7R/X6S                               | 50V~100V   | C ≥ 2.2µF  | 6.3V                               | ≤ 30%   | ---  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 1825<br>2220<br>2225   | X7R                                       | 100V~250V  | C ≥ 1.0µF  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| *Test time: 1000+24/-0 hrs.  |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.  |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| Cap. / (DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.  |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| * De-rating conditions:  |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
|  |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3µF</td> <td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF</td> </tr> <tr> <td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥ 1812</td> </tr> </tbody> </table>  |   | Rated voltage  | Insulation Resistance  | 100V: All X7R; 1210 ≥ 3.3µF        | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller.   | 50V: 0402 > 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF | 35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF   | 25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF | 16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF | 6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥ 1812 |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| Rated voltage  | Insulation Resistance                     |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 100V: All X7R; 1210 ≥ 3.3µF  | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 50V: 0402 > 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF  |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |
| 6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥ 1812   |   |  |  |                                    |   |  |  |  |  |   |  |                          |             |                    |   |           |  |       |                     |                     |           |             |                                   |       |          |  |      |                 |                     |   |            |                                   |                    |                        |  |        |  |                   |                      |          |   |        |                      |  |                         |                                    |               |                       |          |                                   |         |  |  |             |                    |           |           |          |                     |      |             |  |           |      |       |           |                      |   |           |           |   |      |     |           |           |            |   |      |          |   |      |             |       |          |            |   |      |          |           |      |     |      |          |          |     |     |     |     |

**APPENDIXES**

■ Tape & reel dimensions



Fig. 2 The dimension of paper tape



Fig. 3 The dimension of plastic tape

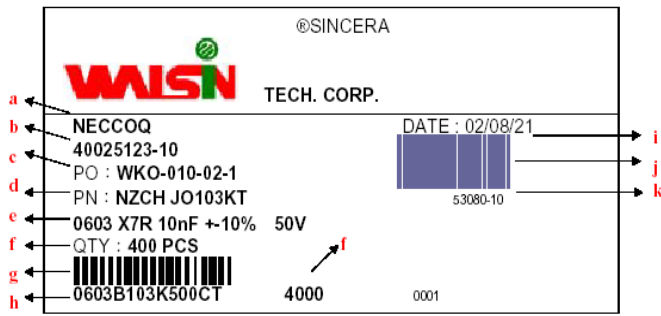
| Size                    | 0201             | 0402             | 0603             | 0805             |                  |                  | 1206             |                  |                  | 1210             |                  |                  | 1808             | 1812             |                  |
|-------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Thickness               | L                | N,E              | S,H,X            | A,H              | B,T              | D,I              | B,T              | C,J,D            | G,P              | T                | C,D,G,K          | M                | D,F,G,K          | D,F,G,K          | M,U              |
| <b>A<sub>0</sub></b>    | 0.39<br>+/-0.07  | 0.70<br>+/-0.2   | 1.05<br>+/-0.30  | 1.50<br>+/-0.20  | 1.50<br>+/-0.20  | < 1.80           | 1.90<br>+/-0.50  | < 2.00           | <2.30            | < 3.05           | < 3.05           | < 3.20           | < 2.50           | < 3.90           | < 3.90           |
| <b>B<sub>0</sub></b>    | 0.69<br>+/-0.07  | 1.20<br>+/-0.2   | 1.80<br>+/-0.30  | 2.30<br>+/-0.20  | 2.30<br>+/-0.20  | < 2.70           | 3.50<br>+/-0.50  | < 3.70           | < 4.00           | < 3.80           | < 3.80           | <3.95            | < 5.30           | < 5.30           | < 5.30           |
| <b>T</b>                | ≤ 0.50           | ≤ 0.80           | ≤ 1.20           | ≤ 1.15           | ≤ 1.30           | 0.23<br>+/-0.1   | ≤ 1.30           | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   |
| <b>K<sub>0</sub></b>    | -                | -                | -                | -                | -                | < 2.50           | -                | < 2.50           | < 2.50           | < 1.50           | < 2.50           | < 3.20           | < 2.50           | < 2.50           | < 3.50           |
| <b>W</b>                | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.20  | 8.00<br>+/-0.10  | 8.00<br>+/-0.20  | 8.00<br>+/-0.20  | 8.00<br>+/-0.20  | 8.00<br>+/-0.20  | 8.00<br>+/-0.20  | 12.00<br>+/-0.20 | 12.00<br>+/-0.20 | 12.00<br>+/-0.20 |
| <b>P<sub>0</sub></b>    | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  |
| <b>10xP<sub>0</sub></b> | 40.00<br>+/-0.10 | 40.00<br>+/-0.10 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 |
| <b>P<sub>1</sub></b>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  |
| <b>P<sub>2</sub></b>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  |
| <b>D<sub>0</sub></b>    | 1.55<br>+/-0.05  | 1.55<br>+/-0.05  | 1.55<br>+/-0.05  | 1.55<br>+/-0.05  | 1.55<br>+/-0.05  | 1.50<br>+0.1/-0  | 1.55<br>+/-0.05  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  |
| <b>D<sub>1</sub></b>    | -                | -                | -                | -                | -                | 1.00<br>+/-0.10  | -                | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  |
| <b>E</b>                | 1.75<br>+/-0.05  | 1.75<br>+/-0.05  | 1.75<br>+/-0.05  | 1.75<br>+/-0.05  | 1.75<br>+/-0.05  | 1.75<br>+/-0.10  | 1.75<br>+/-0.05  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  |
| <b>F</b>                | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  |



Fig. 4 The dimension of reel

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

▣ Description of customer label



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

▣ Constructions

| No. | Name             | NPO, X7R, X5R, X6S, X7S, Y5V |
|-----|------------------|------------------------------|
| ①   | Ceramic material | BaTiO <sub>3</sub> 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 N<sub>2</sub> within oven are recommended.



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



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

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[NIN-FC2R7JTRF](#) [NMC0201X5R474K4TRPF](#) [NMC0402NPO220J50TRPF](#) [NMC0402X5R105K6.3TRPF](#) [NMC0402X5R224K6.3TRPF](#)  
[NMC0402X7R103J25TRPF](#) [NMC0402X7R153K16TRPF](#) [NMC0603NPO1R8C50TRPF](#) [NMC0603NPO201J50TRPF](#)  
[NMC0603NPO330G50TRPF](#) [NMC0603X5R475M6.3TRPF](#) [NMC0805NPO270J50TRPF](#) [NMC0805NPO820J50TRPF](#)  
[NMC0805X7R224K25TRPF](#) [NMC1206X7R102K50TRPF](#) [NMC-H0805X7R472K250TRPF](#) [NMC-L0402NPO7R0C50TRPF](#) [NMC-](#)  
[L0603NPO2R2B50TRPF](#) [NMC-P0805NPO221J500TRPLPF](#) [NMC-Q0402NPO8R2D200TRPF](#) [C1206C101J1GAC](#) [C1608C0G2A221J](#)  
[C1608X7R1E334K](#) [C2012C0G2A472J](#) [2220J2K00562KXT](#) [1812J2K00332KXT](#) [CDR31BX103AKWR](#) [CDR33BX104AKUR](#)  
[CDR33BX683AKUS](#) [CGA2B2C0G1H010C](#) [CGA2B2C0G1H040C](#) [CGA2B2C0G1H050C](#) [CGA2B2C0G1H060D](#) [CGA2B2C0G1H070D](#)  
[CGA2B2C0G1H120J](#) [CGA2B2C0G1H151J](#) [CGA2B2C0G1H181JT0Y0F](#) [CGA2B2C0G1H1R5C](#) [CGA2B2C0G1H2R2C](#)  
[CGA2B2C0G1H390J](#) [CGA2B2C0G1H391J](#) [CGA2B2C0G1H3R3C](#) [CGA2B2C0G1H680J](#) [CGA2B2C0G1H6R8D](#)