

# APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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

## Multilayer Ceramic Capacitors

### 1. DESCRIPTION

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

WTC's MLCC is made by NP0, X7R, X6S, X7S and X5R 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).

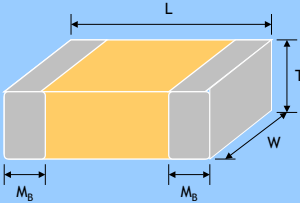
### 3. APPLICATIONS

- 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)   | N=NP0<br>(C0G)    | Two significant<br>digits followed by<br>no. of zeros. And<br>R is in place of<br>decimal point. | A=±0.05pF<br>B=±0.1pF<br>C=±0.25pF<br>D=±0.5pF<br>F=±1%<br>G=±2%<br>J=±5%<br>K=±10%<br>M=±20% | Two significant<br>digits followed by<br>no. of zeros. And<br>R is in place of<br>decimal point.              | C=Cu/Ni/Sn         | T=7" reeled<br>G=13" reeled |
| 0201 (0603) |                   |                                                                                                  |                                                                                               |                                                                                                               |                    |                             |
| 0402 (1005) | B=X7R             |                                                                                                  |                                                                                               |                                                                                                               |                    |                             |
| 0603 (1608) | F=Y5V             |                                                                                                  |                                                                                               |                                                                                                               |                    |                             |
| 0805 (2012) | X=X5R             |                                                                                                  |                                                                                               |                                                                                                               |                    |                             |
| 1206 (3216) | S=X6S             |                                                                                                  |                                                                                               |                                                                                                               |                    |                             |
| 1210 (3225) | A=X7S             | eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>104=10x10 <sup>4</sup><br>=100nF                               |                                                                                               | 4R0=4 VDC<br>6R3=6.3 VDC<br>100=10 VDC<br>160=16 VDC<br>250=25 VDC<br>350=35 VDC<br>500=50 VDC<br>101=100 VDC |                    |                             |
| 1812 (4532) |                   |                                                                                                  |                                                                                               |                                                                                                               |                    |                             |

## 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<br>+0.05/-0.10 |
|                                                                                                                     |                   | 1.00±0.20               | 0.50±0.20               | 0.50+0.02/-0.05              | Q                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 1.00±0.15 <sup>#5</sup>      | 0.50±0.15 <sup>#5</sup> | 0.5±0.15 <sup>#5</sup> |                     |
|                                                                                                                     | 0603 (1608)       | 1.60±0.10               | 0.80±0.10               | 0.80±0.07                    | S                       | R / W                  | 0.40±0.15           |
|                                                                                                                     |                   | 1.60+0.15/-0.10         | 0.80+0.15/-0.10         | 0.50±0.10                    | H                       | R / W                  |                     |
|                                                                                                                     |                   |                         |                         | 0.80±0.10                    | B                       | R / W                  |                     |
|                                                                                                                     |                   |                         |                         | 0.80+0.15/-0.10              | X                       |                        |                     |
|                                                                                                                     |                   | 1.60±0.20 <sup>#1</sup> | 0.80±0.20 <sup>#1</sup> | 0.8±0.20 <sup>#1</sup>       |                         |                        |                     |
|                                                                                                                     | 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                  |                     |
|                                                                                                                     |                   | 2.00±0.20               | 1.25±0.20               | 1.25±0.10                    | D                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 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           |
|                                                                                                                     |                   | 3.20±0.20               |                         | 0.95±0.10                    | C                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 1.25±0.10                    | D                       | R                      |                     |
|                                                                                                                     |                   |                         | 1.60±0.20               | 1.15±0.15                    | J                       | R                      |                     |
|                                                                                                                     |                   | 3.20+0.30/-0.1          |                         | 0.85±0.10                    | T                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 3.30+0.30/-0.1 <sup>#4</sup> | 1.60+0.30/-0.10         | 1.60+0.30/-0.10        |                     |
|                                                                                                                     | 1210 (3225)       | 3.20±0.30               | 2.50±0.20               | 0.95±0.10                    | C                       | R                      | 0.75±0.25           |
|                                                                                                                     |                   | 3.20±0.40               | 2.50±0.30               | 0.85±0.10                    | T                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 1.25±0.10                    | D                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 1.60±0.20                    | G                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 2.00±0.20                    | K                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 2.50±0.30                    | M                       | R                      |                     |
|                                                                                                                     | 1808 (4520)       | 4.50±0.40               | 2.03±0.25               | 1.25±0.10                    | D                       | R                      | 0.75±0.25           |
|                                                                                                                     |                   |                         |                         | 1.40±0.15                    | F                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 1.60±0.20                    | G                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 2.00±0.20                    | K                       | R                      |                     |
|                                                                                                                     | 1812 (4532)       | 4.50±0.40               | 3.20±0.30               | 1.25±0.10                    | D                       | R                      | 0.75±0.25           |
|                                                                                                                     |                   |                         |                         | 1.60±0.20                    | G                       | R                      |                     |
|                                                                                                                     |                   |                         | 3.20±0.40               | 2.00±0.20                    | K                       | R                      |                     |
|                                                                                                                     |                   |                         |                         | 2.50±0.30                    | M                       | R                      |                     |
| 2.80±0.30                                                                                                           |                   |                         |                         | U                            | R                       |                        |                     |

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

#1: For 0603/Cap ≥ 10μF or 0603(≤6.3V)/Cap ≥ 4.7μF or 0603(>10V)/Cap > 1μF products,  
Excluding 0603X225(16V&25V),0603S225(6.3V&16V),0603X475(6.3V&16V),0603S475(4V&6.3V).

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

#3: For 0201X334(16V&25V), 0201/Cap ≥ 0.68μF products, Excluding 0201X105\*6R3=>(L:0.6±0.05,W:0.3±0.05,T:0.3±0.05).

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

#5: For 0402X475M6R3CT products.

## 6. GENERAL ELECTRICAL DATA

| Dielectric                 | NP0                                                                                                                                                                                                              | X7R                                     | X5R                   | X6S                   | X7S                   |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------|-----------------------|-----------------------|
| Size                       | 0201, 0402, 0603, 0805, 1206, 1210, 1812                                                                                                                                                                         |                                         |                       |                       |                       |
| Capacitance range*         | 0.1pF to 0.1μF                                                                                                                                                                                                   | 100pF to 47μF                           | 100pF to 220μF        | 0.1μF to 100μF        | 0.1μF to 100μF        |
| Capacitance tolerance**    | Cap≤5pF <sup>#1</sup> :<br>A (±0.05pF), B (±0.1pF),<br>C (±0.25pF)<br>5pF<Cap<10pF <sup>#1</sup> :<br>A (±0.05pF), B (±0.1pF),<br>C (±0.25pF), D (±0.5pF)<br>Cap≥10pF:<br>F (±1%), G (±2%),<br>J (±5%), K (±10%) | J (±5%),<br>K (±10%),<br>M (±20%)       | K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) | K (±10%),<br>M (±20%) |
| Rated voltage (WVDC)       | 10V, 16V, 25V, 50V, 100V                                                                                                                                                                                         | 4V, 6.3V, 10V, 16V, 25V, 35V, 50V, 100V |                       |                       |                       |
| Operating temperature      | -55 to +125°C                                                                                                                                                                                                    |                                         | -55 to +85°C          | -55 to +105°C         | -55 to +125°C         |
| Capacitance characteristic | ±30ppm                                                                                                                                                                                                           | ±15%                                    | ±15%                  | ±22%                  | ±22%                  |
| Termination                | Ni/Sn (lead-free termination)                                                                                                                                                                                    |                                         |                       |                       |                       |

#1: NP0, 0.1pF and 5pF<Cap<10pF products need to check with sales if it can supply A (±0.05pF).

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

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

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

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



## 7. CAPACITANCE RANGE

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

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

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

2. The letter in cell with " \* " mark is expressed capacitance tolerance "J" (±5%) only.

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

Multilayer Ceramic Capacitors

Approval Sheet

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

| DIELECTRIC          |               | NP0  |    |    |    |     |      |    |    |    |     |      |    |    |     |
|---------------------|---------------|------|----|----|----|-----|------|----|----|----|-----|------|----|----|-----|
| SIZE                |               | 1206 |    |    |    |     | 1210 |    |    |    |     | 1812 |    |    |     |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 16   | 25 | 50 | 100 |
| 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  |     | K    | K  | K  | K  | K   | M    | M  | M  | M   |
|                     | 0.047μF (473) | P    | P  | P  | P  |     | K    | K  | K  | K  | K   | M    | M  | M  | M   |
|                     | 0.056μF (563) | P    | P  | P  | P  |     |      |    |    |    |     | M    | M  | M  | M   |
|                     | 0.068μF (683) | P    | P  | P  | P  |     |      |    |    |    |     | M    | M  | M  | M   |
|                     | 0.082μF (823) | P    | P  | P  | P  |     |      |    |    |    |     | M    | M  | M  | M   |
|                     | 0.1μF (104)   | P    | P  | P  | P  |     |      |    |    |    |     | M    | M  | M  | M   |

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

2. The letter in cell with “\*” mark is expressed capacitance tolerance “J” (±5%) only.

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



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

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

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

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

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

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

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



Multilayer Ceramic Capacitors

Approval Sheet

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

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

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

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

Multilayer Ceramic Capacitors

Approval Sheet

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

| Dielectric          |               | X6S  |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|---------------------|---------------|------|-----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|
| Size                |               | 0201 |     |    |    |    | 0402 |    |    |    |    | 0603 |    |    |    |    | 0805 |    |    |    |    | 1206 |    |    |    |    | 1210 |    |    |    |    |
| Rated Voltage (VDC) |               | 4    | 6.3 | 10 | 16 | 25 | 6.3  | 10 | 16 | 25 | 4  | 6.3  | 10 | 16 | 25 | 4  | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 |
| Capacitance         | 1,000pF (102) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 1,500pF (152) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 2,200pF (222) |      |     | L  |    |    |      | N  |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 2,700pF (272) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 3,300pF (332) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 4,700pF (472) |      |     | L  |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 6,800pF (682) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 8,200pF (822) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.010μF (103) |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.015μF (153) | L    | L   | L  |    |    |      | N  |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.022μF (223) | L    | L   | L  |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.033μF (333) | L    | L   | L  |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.047μF (473) | L    | L   | L  |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.068μF (683) | L    | L   | L  |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.082μF (823) | L    | L   | L  |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.10μF (104)  | L    | L   | L  | L  | L  | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.15μF (154)  |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.22μF (224)  |      | L   | L* |    |    | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.33μF (334)  |      |     |    |    |    | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.47μF (474)  | L    |     |    |    |    | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 0.68μF (684)  |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 1.0μF (105)   | L*   | L*  |    |    |    | N    | N  | N  | E  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 1.5μF (155)   |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 2.2μF (225)   |      |     |    |    |    | E    | E  | E  |    |    | X    | X  | X  | X  |    |      |    |    |    | I  |      |    |    |    |    |      |    |    |    |    |
|                     | 3.3μF (335)   |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|                     | 4.7μF (475)   |      |     |    |    |    | E    | E  |    |    |    | X    | X  | X  | X  | X  |      |    |    |    | I  | I    |    |    |    |    |      |    |    |    |    |
|                     | 6.8uF (685)   |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
| 10μF (106)          |               |      |     |    |    | E* |      |    |    |    | X* | X*   | X* | X* |    | I  | I    | I  | I  | I  |    |      |    |    |    | P  |      |    |    |    |    |
| 22μF (226)          |               |      |     |    |    |    |      |    |    |    | X* | X*   |    |    |    | I* | I*   | I* | I* |    |    |      | P  | P* | P  |    |      |    |    | M  |    |
| 47μF (476)          |               |      |     |    |    |    |      |    |    |    |    |      |    |    |    | I* | I*   |    |    |    |    |      | P  |    |    |    |      |    | M  | M  | M  |
| 100μF (107)         |               |      |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    | M* | M* |    |

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

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

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

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

## 8. PACKAGING STYLE AND QUANTITY

| Size        | Thickness (mm)/Symbol |   | Paper tape |          | Plastic tape |          |
|-------------|-----------------------|---|------------|----------|--------------|----------|
|             |                       |   | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0201 (0603) | 0.30±0.03             | L | 15,000     | 70,000   | -            | -        |
|             | 0.30±0.05             | L | 15,000     | 50,000   | -            | -        |
|             | 0.30±0.09             | L | 15,000     | 50,000   | -            | -        |
| 0402 (1005) | 0.50±0.05             | N | 10,000     | 50,000   | -            | -        |
|             | 0.50+0.02/-0.05       | Q | 10,000     | 50,000   | -            | -        |
|             | 0.50±0.20             | E | 10,000     | 40,000   | -            | -        |
| 0603 (1608) | 0.50±0.10             | H | 4,000      | 20,000   | -            | -        |
|             | 0.80±0.07             | S | 4,000      | 15,000   | -            | -        |
|             | 0.80±0.10             | B | 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        | 8,000    |
|             | 2.00±0.20             | K | -          | -        | 1,000        | 6,000    |
|             | 2.50±0.30             | M | -          | -        | 1,000        | 6,000    |
| 1808 (4520) | 1.25±0.10             | D | -          | -        | 2,000        | 10,000   |
|             | 1.40±0.15             | F | -          | -        | 2,000        | 10,000   |
|             | 1.60±0.20             | G | -          | -        | 2,000        | 8,000    |
|             | 2.00±0.20             | K | -          | -        | 1,000        | 6,000    |
| 1812 (4532) | 1.25±0.10             | D | -          | -        | 1,000        | 5,000    |
|             | 1.60±0.20             | G | -          | -        | 1,000        | 3,000    |
|             | 2.00±0.20             | K | -          | -        | 1,000        | 3,000    |
|             | 2.50±0.30             | M | -          | -        | 500          | 3,000    |
|             | 2.80±0.30             | U | -          | -        | 500          | 1,500    |

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                     | *Test temp.: Room Temperature.<br>*Class I: (NP0)<br>≤1000pF, 1.0±0.2Vrms · 1MHz±10%<br>> 1000pF, 1.0±0.2Vrms · 1KHz±10%<br>Class II: (X7R, X7E, X6S, X5R,X7S)<br>C≤10μF, 1.0±0.2Vrms · 1KHz±10% **<br>C> 10μF, 0.5±0.2Vrms · 120Hz±20%                                                                                                                                                                                                                                                                                                                                                               | * Shall not exceed the limits given in the detailed spec.<br>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C<br>X7R: |                         |                                                        |                                                                      |               |
| 3.   | Q/ D.F.<br>(Dissipation Factor) | ** Test condition: 0.5±0.2Vrms · 1KHz±10%<br>X7R:<br>0603/475(6.3V)<br>X5R <sup>#1</sup> :<br>0201≥224 (6.3V,10V,16V),<br>0402≥475 (6.3V,16V), 0402≥225(10V),<br>0603=106 (6.3V)<br>TT18X≥475(10V) , TT15X series<br>X6S:<br>0201/474(4V),0201>104 (6.3V,10V),<br>0402≥225 (6.3V),<br>0402/475 (10V), 0603/106 (6.3V),<br>X7S:<br>0402/225(6.3V)<br><br>#1 Excluding<br>X5R/0201/105(6.3V);225(10V);224(16V),<br>0402X475M6R3, 0402X106M100<br>(1.0±0.2Vrms · 1KHz±10%)<br><br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. |                                                                                                                |                         |                                                        |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Rated vol.                                                                                                     | D.F.≤                   | Exception of D.F. ≤                                    |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ≥100V                                                                                                          | ≤2.5%                   | ≤3%                                                    | 1206 ≥ 0.47μF                                                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤3.5%                                                  | 1812 ≥ 4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤5%                                                    | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;              |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0805 > 0.22μF; 1210 ≥ 3.3μF                                          |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 50V                                                                                                            | ≤2.5%                   | ≤3%                                                    | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF              |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤3.5%                                                  | 1812 ≥ 4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤5%                                                    | 0201 ≥ 0.01uF; 0402≥0.012μF; 1210 ≥ 3.3μF                            |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 35V                                                                                                            | ≤3.5%                   | ≤10%                                                   | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                    |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤5%                                                    | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF                               |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25V                                                                                                            | ≤3.5%                   | ≤7%                                                    | 0603 ≥ 0.33μF                                                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF;                         |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF                              |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | ≤12.5%                                                               | 0402 ≥ 0.33μF |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 16V                                                                                                            | ≤3.5%                   | ≤5%                                                    | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF;                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF              |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0201/X7R ≥ 0.022μF; 0402 ≥ 0.15uF;                                   |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF                 |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10V                                                                                                            | ≤5%                     | ≤10%                                                   | 0201 ≥ 0.012μF; 0402 ≥ 0.15μF;                                       |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤15%                                                   | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                             |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤20%                                                   | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF;                               |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF                                                                        |                         |                                                        |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6.3V                                                                                                           | ≤10%                    | ≤15%                                                   | 0402 ≥ 2.2μF                                                         |               |
| ---  |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        |                                                                      |               |
| 4V   | ≤15%                            | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                |                         |                                                        |                                                                      |               |
| 3.   | Q/ D.F.<br>(Dissipation Factor) | ** Test condition: 0.5±0.2Vrms · 1KHz±10%<br>X7R:<br>0603/475(6.3V)<br>X5R <sup>#1</sup> :<br>0201≥224 (6.3V,10V,16V),<br>0402≥475 (6.3V,16V), 0402≥225(10V),<br>0603=106 (6.3V)<br>TT18X≥475(10V) , TT15X series<br>X6S:<br>0201/474(4V),0201>104 (6.3V,10V),<br>0402≥225 (6.3V),<br>0402/475 (10V), 0603/106 (6.3V),<br>X7S:<br>0402/225(6.3V)<br><br>#1 Excluding<br>X5R/0201/105(6.3V);225(10V);224(16V),<br>0402X475M6R3, 0402X106M100<br>(1.0±0.2Vrms · 1KHz±10%)<br><br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. |                                                                                                                |                         |                                                        |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Rated vol.                                                                                                     | D.F.≤                   | Exception of D.F. ≤                                    |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ≥100V                                                                                                          | ≤2.5%                   | ≤3%                                                    | 1206 ≥ 0.47μF                                                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤5%                                                    | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF               |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0805 > 0.22μF; 1210 ≥ 3.3μF                                          |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤3%                                                    | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF              |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 50V                                                                                                            | ≤2.5%                   | ≤5%                                                    | 0201 ≥ 0.01uF; 0402 ≥ 0.012μF;1210 ≥ 3.3μF                           |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0402 ≥ 0.047μF; 0603>0.1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF     |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤12.5%                                                 | 1206=10μF                                                            |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤3.5%                                                  | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                    |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 35V                                                                                                            | ≤3.5%                   | ≤5%                                                    | 0201=0.01μF; 0805 ≥ 1μF                                              |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤7%                                                    | 0603 ≥ 0.33μF                                                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0201>0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF;                           |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF                              |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ≤12.5%                                                                                                         | 0402 ≥ 0.33μF;0805=10μF |                                                        |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25V                                                                                                            | ≤3.5%                   | ≤5%                                                    | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF;                        |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF              |                                                                      |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0201>0.01uF; 0402 ≥ 0.22uF;                                          |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF                 |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 16V                                                                                                            | ≤3.5%                   | ≤12.5%                                                 | 0402 ≥ 1μF;0805=10μF                                                 |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF;                                       |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R     |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | ≤15%                                                                 | 0805=10μF     |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10V                                                                                                            | ≤5%                     | ≤15%                                                   | 0201>0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF                                  |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         | ≤10%                                                   | 0201>0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF;                                 |               |
|      |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        | 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF                              |               |
| ≤20% | 0402 ≥ 2.2μF                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                |                         |                                                        |                                                                      |               |
| 6.3V | ≤10%                            | ≤15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ---                                                                                                            |                         |                                                        |                                                                      |               |
|      |                                 | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                |                         |                                                        |                                                                      |               |
| 4V   | ≤15%                            | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                |                         |                                                        |                                                                      |               |

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

| No.           | Item                                                               | Test Condition      | Requirements                                                                           |       |                     |                                                                                        |  |
|---------------|--------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------|-------|---------------------|----------------------------------------------------------------------------------------|--|
|               | Q/ D.F.<br>(Dissipation<br>Factor)                                 |                     | X6S:                                                                                   |       |                     |                                                                                        |  |
|               |                                                                    |                     | Rated<br>vol.                                                                          | D.F.≤ | Exception of D.F. ≤ |                                                                                        |  |
|               |                                                                    |                     | ≥100V                                                                                  | ≤2.5% | ≤3%                 | 1206 ≥ 0.47μF                                                                          |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |  |
|               |                                                                    |                     | 50V                                                                                    | ≤2.5% | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0201 ≥ 0.01uF;1210 ≥ 3.3μF                                                             |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |  |
|               |                                                                    |                     | 35V                                                                                    | ≤3.5% | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |  |
|               |                                                                    |                     |                                                                                        |       | ≤7%                 | 0603 ≥ 0.33μF                                                                          |  |
|               |                                                                    |                     | 25V                                                                                    | ≤3.5% | ≤10%                | 0201 ≥ 0.1μF; 0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF   |  |
|               |                                                                    |                     |                                                                                        |       | ≤12.5%              | 0402 ≥ 0.33μF;0805=10μF                                                                |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF     |  |
|               |                                                                    |                     | 16V                                                                                    | ≤3.5% | ≤12.5%              | 0402=1μF;0805=10μF                                                                     |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |  |
|               |                                                                    |                     |                                                                                        |       | ≤15%                | 0805=10μF                                                                              |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |  |
|               |                                                                    |                     | 10V                                                                                    | ≤5%   | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 0.47μF; 0603 ≥ 10μF;<br>0805 ≥ 4.7μF;1206 ≥ 47μF; 1210 ≥ 100μF     |  |
|               |                                                                    |                     |                                                                                        |       | ≤20%                | 0402 ≥ 2.2μF                                                                           |  |
|               |                                                                    |                     |                                                                                        |       | ---                 | ---                                                                                    |  |
|               |                                                                    |                     |                                                                                        |       | X7S:                |                                                                                        |  |
|               |                                                                    |                     | Rated<br>vol.                                                                          | D.F.≤ | Exception of D.F. ≤ |                                                                                        |  |
|               |                                                                    |                     | ≥100V                                                                                  | ≤2.5% | ≤3%                 | 1206 ≥ 0.47μF                                                                          |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |  |
|               |                                                                    |                     | 50V                                                                                    | ≤2.5% | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |  |
|               |                                                                    |                     | 35V                                                                                    | ≤3.5% | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |  |
|               |                                                                    |                     |                                                                                        |       | ≤7%                 | 0603 ≥ 0.33μF                                                                          |  |
|               |                                                                    |                     | 25V                                                                                    | ≤3.5% | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |  |
|               |                                                                    |                     |                                                                                        |       | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |  |
|               |                                                                    |                     | 16V                                                                                    | ≤3.5% | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |  |
|               |                                                                    |                     |                                                                                        |       | ≤20%                | 0402 ≥ 2.2μF                                                                           |  |
|               |                                                                    |                     |                                                                                        |       | ---                 | ---                                                                                    |  |
|               |                                                                    |                     | 10V                                                                                    | ≤5%   | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |  |
|               |                                                                    |                     |                                                                                        |       | ≤20%                | 0402 ≥ 2.2μF                                                                           |  |
|               |                                                                    |                     |                                                                                        |       | ---                 | ---                                                                                    |  |
|               |                                                                    |                     |                                                                                        |       | X7S:                |                                                                                        |  |
|               |                                                                    |                     | Rated<br>vol.                                                                          | D.F.≤ | Exception of D.F. ≤ |                                                                                        |  |
|               |                                                                    |                     | ≥100V                                                                                  | ≤2.5% | ≤3%                 | 1206 ≥ 0.47μF                                                                          |  |
|               |                                                                    |                     |                                                                                        |       | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |  |
|               |                                                                    |                     |                                                                                        |       | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |  |
|               |                                                                    |                     | 50V                                                                                    | ≤2.5% | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |  |
| ≤5%           | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                        |                     |                                                                                        |       |                     |                                                                                        |  |
| ≤10%          | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF |                     |                                                                                        |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2μF;1210 ≥ 10μF                     |       |                     |                                                                                        |  |
| 35V           | ≤3.5%                                                              | ≤10%                | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                         |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                                   |       |                     |                                                                                        |  |
|               |                                                                    | ≤7%                 | 0603 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
| 25V           | ≤3.5%                                                              | ≤10%                | 0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF    |       |                     |                                                                                        |  |
|               |                                                                    | ≤12.5%              | 0402 ≥ 0.33μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF;<br>0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.1uF; 0402 ≥ 0.22uF;<br>0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF     |       |                     |                                                                                        |  |
| 16V           | ≤3.5%                                                              | ≤15%                | 0201 ≥ 0.1μF; 0402 ≥ 1μF                                                               |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF  |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
| 10V           | ≤5%                                                                | ≤15%                | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF        |       |                     |                                                                                        |  |
|               |                                                                    | ≤20%                | 0402 ≥ 2.2μF                                                                           |       |                     |                                                                                        |  |
|               |                                                                    | ---                 | ---                                                                                    |       |                     |                                                                                        |  |
|               |                                                                    | X7S:                |                                                                                        |       |                     |                                                                                        |  |
| Rated<br>vol. | D.F.≤                                                              | Exception of D.F. ≤ |                                                                                        |       |                     |                                                                                        |  |
| ≥100V         | ≤2.5%                                                              | ≤3%                 | 1206 ≥ 0.47μF                                                                          |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                                    |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0805 > 0.22μF;1210 ≥ 3.3μF                                                             |       |                     |                                                                                        |  |
| 50V           | ≤2.5%                                                              | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                                 |       |                     |                                                                                        |  |
|               |                                                                    | ≤5%                 | 0201 ≥ 0.01uF; 1210 ≥ 3.3μF                                                            |       |                     |                                                                                        |  |
|               |                                                                    | ≤10%                | 0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF;<br>1206 ≥ 2.2                                   |       |                     |                                                                                        |  |

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

| No | Item                    | Test Condition                                                                                                                                                                                                                                                                                                                                                                | Requirements                                                                                                                                              |
|----|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. | Insulation Resistance   | *Test temp.: Room Temperature.<br>*To apply rated voltage for MAX. 120sec.                                                                                                                                                                                                                                                                                                    | 10GΩ or RxC≥500Ω-F whichever is smaller.                                                                                                                  |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Class II (X7R, X7E, X5R,X6S,X7S,Y5V:)                                                                                                                     |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Rated voltage                                                                                                                                             |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 100V: All X7R                                                                                                                                             |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF                                                                                              |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF                                                                                                                    |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF                                                                                               |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF                                                                                  |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF                                                                               |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 6.3V ; 4V ; Size≥1812                                                                                                                                     |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Rated voltage                                                                                                                                             |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | All X6S items, All X7S items                                                                                                                              |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 100V: 1210≥3.3μF                                                                                                                                          |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF; 1206≥10μF                                                                                                         |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 35V: 0603≥1μF;                                                                                                                                            |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 25V: 0201≥0.1μF; 0402≥2.2μF; 0603≥10μF; 0805≥10μF; 1206≥22μF                                                                                              |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF                                                                                                                     |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF                                                                                                           |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 6.3V: 0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF                                                                                              |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 4V: 0603≥22μF; 0805≥47μF; 1206≥100μF                                                                                                                      |
| 6. | Temperature Coefficient | With no electrical load.<br>T.C.      Operating Temp<br>NPO      -55~125°C at 25°C<br>X7R      -55~125°C at 25°C<br>X7S      -55 ~ 125°C at 25°C<br>X5R      -55~ 85°C at 25°C<br>X6S      -55~105°C at 25°C<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 voltage for Class II: | T.C.      Capacitance Change<br>NPO      Within ±30ppm/°C<br>X7R      Within ±15%<br>X7S      Within ±22%<br>X5R      Within ±15%<br>X6S      Within ±22% |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 01005      0201                                                                                                                                           |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap≤0.01μF: 0.5V      Cap<0.1μF: 1V                                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap>0.01μF: 0.2V      0.1μF≤Cap<1μF: 0.2V*                                                                                                                |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap≥1μF: 0.1V*                                                                                                                                            |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | *0201X104/6.3V~25V: 0.5V      *0201B104/6.3V~10V: 0.3V                                                                                                    |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0201X224/10V~25V: 0.5V      0201S104/6.3V~16V: 0.3V                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0201S224/6.3V: 0.3V                                                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0201X334/474/105-6.3V&10V: 0.3V                                                                                                                           |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0402      0603                                                                                                                                            |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap<1μF: 1V      Cap<1μF: 1V                                                                                                                              |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap=1μF: 0.5V**      1μF≤Cap≤4.7μF: 0.5V                                                                                                                  |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0402B224-16V: 0.5V      0603X106-10V: 0.5V                                                                                                                |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0402B334/474-6.3V&10V: 0.5V                                                                                                                               |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0402S334/474-6.3V: 0.5V                                                                                                                                   |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0402X225/475-6.3V: 0.5V                                                                                                                                   |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 1μF<Cap<10μF: 0.2V      Cap>4.7μF: 0.2V                                                                                                                   |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | **0402B105M6R3V: 0.2V                                                                                                                                     |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap≥10μF: 0.1V                                                                                                                                            |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0805      1206/1210                                                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap<10μF: 1V      Cap≤10μF: 1V                                                                                                                            |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap=10μF: 0.5V      10μF<Cap≤100μF: 0.5V                                                                                                                  |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 0805B475/6.3V~25V: 0.5V                                                                                                                                   |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | Cap>10μF: 0.2V      Cap>100μF: 0.2V                                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 1206X107-6.3V: 0.2V                                                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 1206A476-6.3V: 0.1V                                                                                                                                       |
|    |                         |                                                                                                                                                                                                                                                                                                                                                                               | 1210S107-6.3V: 0.2V                                                                                                                                       |

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



Multilayer Ceramic Capacitors

Approval Sheet

| No.  | Item                             | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Requirements                                                                                                                                                                                                                                                                    |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
|------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.   | Adhesive Strength of Termination | * Pressurizing force :<br>2N (0201) and 5N (≤0603) and 10N (>0603)<br>* Test time: 10±1 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | * No remarkable damage or removal of the terminations.                                                                                                                                                                                                                          |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 8.   | Vibration Resistance             | * Vibration frequency: 10~55 Hz/min.<br>* Total amplitude: 1.5mm<br>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)<br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>*Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.                                                                                                                                                                                                                                           | * No remarkable damage.<br>* Cap change and Q/D.F.: To meet initial spec.                                                                                                                                                                                                       |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 9.   | Solderability                    | * Solder temperature: 235±5°C<br>* Dipping time: 2±0.5 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 95% min. coverage of all metalized area.                                                                                                                                                                                                                                        |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 10.  | Bending Test                     | * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.<br>*Before initial measurement (Class II only):<br>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                 | * No remarkable damage.<br>* Cap change :<br>NP0: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±12.5%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 11.  | Resistance to Soldering Heat     | * Solder temperature: 260±5°C<br>* Dipping time: 10±1 sec<br>* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.<br>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>*Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.                                                                                                                                                                                                                                | * No remarkable damage.<br>* Cap change:<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±7.5%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.<br>* 25% max. leaching on each edge.                                   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 12.  | Temperature Cycle                | * Conduct the five cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><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></table> *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. | Step                                                                                                                                                                                                                                                                            | Temp. (°C) | Time (min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | * No remarkable damage.<br>* Cap change :<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±7.5%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements. |
| Step | Temp. (°C)                       | Time (min.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                 |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 1    | Min. operating temp. +0/-3       | 30±3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                 |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 2    | Room temp.                       | 2~3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                 |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 3    | Max. operating temp. +3/-0       | 30±3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                 |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 4    | Room temp.                       | 2~3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                 |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |

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

Multilayer Ceramic Capacitors

Approval Sheet

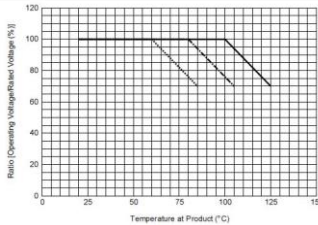
| No.                                                                                     | Item                                      | Test Condition                                                                                                                                                                                                                                                                                                                            | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|-----------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|---------------------|--|-------|-----|-----|---------------|-----|--------------------------------------------------------|-------|--------------------------------------------------------|------|-----------------------------|-----|-----|-----|---------------------------------------------------------|-----|--------------------------------------------------------|------|---------------------------------------------|------|------------------------------------------------------------------------------------------|-----|-----|------|-----------------------------------------------------|-----|-----|------|-------------------------------------------------------------|------|---------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------|-----|-----|------|----------------------------------------------------------|-----|-------|------|------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------|------|------|------|-----------------------------------------------------|----|------|-----|-----|---------------|-----------------------|-----------------------------|-------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------|
| 13.                                                                                     | Humidity (Damp Heat) Steady State         | <p>*Test temp.: 40±2°C</p> <p>*Humidity: 90~95%RH</p> <p>*Test time: 500+24/-0hrs.</p> <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.</p> <p>* 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.</p> <p>* Cap change:<br/>NP0: within ±5% or 0.5pF whichever is larger<br/>X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br/>**10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%;</p> <p>* 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:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="4">≥100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206 ≥ 0.47μF</td></tr><tr><td>≤7%</td><td>1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td></tr><tr><td>≤7.5%</td><td>0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td></tr><tr><td>≤20%</td><td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td></tr><tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>≤7%</td><td>1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td></tr><tr><td>≤10%</td><td>0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF</td></tr><tr><td>≤20%</td><td>0402 ≥ 0.047μF; 0603 &gt; 0.1μF; 0805 ≥ 1μF (0805/X7R &gt; 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF;</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201 ≥ 0.01μF (0201/X5R = 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF*)</td></tr><tr><td>≤14%</td><td>0603 ≥ 0.33μF</td></tr><tr><td>≤15%</td><td>0201 ≥ 0.1μF (0201/X5R &gt; 0.01μF); 0603 ≥ 0.47μF; TT series 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*</td></tr><tr><td>≤20%</td><td>0402 ≥ 0.33μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10%</td><td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤20%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr></table> <p>*1.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.</p> <p>Class II (X7R, X5R, X6S, X7S)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><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 ; All X6S/X7S items; Size ≥ 1812</td></tr></table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥100V | ≤3% | ≤6% | 1206 ≥ 0.47μF | ≤7% | 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF | ≤7.5% | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤20% | 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤3% | ≤6% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤7% | 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF | ≤10% | 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF | ≤20% | 0402 ≥ 0.047μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; | 35V | ≤5% | ≤20% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V | ≤5% | ≤10% | 0201 ≥ 0.01μF (0201/X5R = 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF*) | ≤14% | 0603 ≥ 0.33μF | ≤15% | 0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TT series 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)* | ≤20% | 0402 ≥ 0.33μF | 16V | ≤5% | ≤10% | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 10V | ≤7.5% | ≤15% | 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤20% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | 6.3V | ≤15% | ≤30% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R | 4V | ≤20% | --- | --- | Rated voltage | Insulation Resistance | 100V: All X7R; 1210 ≥ 3.3μF | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V ; 4V ; All X6S/X7S items; Size ≥ 1812 |
| Rated vol.                                                                              | D.F. ≤                                    | Exception of D.F. ≤                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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                                    |      |                                                                                          |     |     |      |                                                     |     |     |      |                                                             |      |               |      |                                                                                                                                                           |      |               |     |     |      |                                                          |     |       |      |                                                                                                            |      |                                                                                                           |      |      |      |                                                     |    |      |     |     |               |                       |                             |                                           |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| ≥100V                                                                                   | ≤3%                                       | ≤6%                                                                                                                                                                                                                                                                                                                                       | 1206 ≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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                                    |      |                                                                                          |     |     |      |                                                     |     |     |      |                                                             |      |               |      |                                                                                                                                                           |      |               |     |     |      |                                                          |     |       |      |                                                                                                            |      |                                                                                                           |      |      |      |                                                     |    |      |     |     |               |                       |                             |                                           |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤7%                                                                                                                                                                                                                                                                                                                                       | 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤7.5%                                                                                                                                                                                                                                                                                                                                     | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤20%                                                                                                                                                                                                                                                                                                                                      | 0805 > 0.22μF; 1210 ≥ 3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 50V                                                                                     | ≤3%                                       | ≤6%                                                                                                                                                                                                                                                                                                                                       | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤7%                                                                                                                                                                                                                                                                                                                                       | 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤10%                                                                                                                                                                                                                                                                                                                                      | 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤20%                                                                                                                                                                                                                                                                                                                                      | 0402 ≥ 0.047μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF;                                                                                                                                                                                                                                                                                                                                                                                                                                                             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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 35V                                                                                     | ≤5%                                       | ≤20%                                                                                                                                                                                                                                                                                                                                      | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 25V                                                                                     | ≤5%                                       | ≤10%                                                                                                                                                                                                                                                                                                                                      | 0201 ≥ 0.01μF (0201/X5R = 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF*)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤14%                                                                                                                                                                                                                                                                                                                                      | 0603 ≥ 0.33μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤15%                                                                                                                                                                                                                                                                                                                                      | 0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TT series 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*                                                                                                                                                                                                                                                                                                                                                                                            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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤20%                                                                                                                                                                                                                                                                                                                                      | 0402 ≥ 0.33μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 16V                                                                                     | ≤5%                                       | ≤10%                                                                                                                                                                                                                                                                                                                                      | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 10V                                                                                     | ≤7.5%                                     | ≤15%                                                                                                                                                                                                                                                                                                                                      | 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
|                                                                                         |                                           | ≤20%                                                                                                                                                                                                                                                                                                                                      | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF                                                                                                                                                                                                                                                                                                                                                                                                                                            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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 6.3V                                                                                    | ≤15%                                      | ≤30%                                                                                                                                                                                                                                                                                                                                      | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 4V                                                                                      | ≤20%                                      | ---                                                                                                                                                                                                                                                                                                                                       | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| Rated voltage                                                                           | Insulation Resistance                     |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 100V: All X7R; 1210 ≥ 3.3μF                                                             | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF                  |                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                |                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF  |                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF    |                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                    |      |                                                                                          |     |     |      |                                                     |     |     |      |                                                             |      |               |      |                                                                                                                                                           |      |               |     |     |      |                                                          |     |       |      |                                                                                                            |      |                                                                                                           |      |      |      |                                                     |    |      |     |     |               |                       |                             |                                           |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF |                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |
| 6.3V ; 4V ; All X6S/X7S items; Size ≥ 1812                                              |                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                |                                                                        |                                                          |                                                                                        |                                                                                      |                                                                                         |                                            |

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

Multilayer Ceramic Capacitors

| No                                                                      | Item                                     | Test Condition                                                                                                                                                                                                                                                                                                                                                                                         | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
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-----|----------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------|
| 14                                                                      | Humidity (Damp Heat) Load                | <p>*Test temp. : 40±2°C</p> <p>*Humidity : 90~95%RH</p> <p>*Test time : 500+24/-0 hrs.</p> <p>*To apply voltage :<br/>Rated voltage (MAX. 500V)</p> <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.</p> <p>* 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.</p> <p>Cap change:<br/>NP0: ±7.5% or 0.75pF whichever is larger.<br/>X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤6.3V within ±25%;<br/>**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;<br/>Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%</p> <p>Q/D.F. value:<br/>NP0: C≥30pF,Q≥200;C&lt;30pF, Q≥100+10/3C<br/>X7R, X5R, X6S, X7S:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="4">≥100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206 ≥0.47μF</td></tr><tr><td>≤7%</td><td>1812 ≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤7.5%</td><td>0603 ≥0.068μF;0805 &gt; 0.1μF;1206 ≥1μF; 1210 ≥2.2μF</td></tr><tr><td>≤20%</td><td>0805 &gt; 0.22μF;1210 ≥3.3μF</td></tr><tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603 ≥0.047μF;0805 ≥0.18μF;1206 ≥0.47μF</td></tr><tr><td>≤7%</td><td>1812 ≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤10%</td><td>0201 ≥0.01uF; 0402 ≥0.012μF;1210 ≥3.3μF</td></tr><tr><td>≤20%</td><td>0402 ≥0.047μF;0603&gt;0.1μF;0805 ≥1μF(0805/X7R&gt;0.47μF); 1206 ≥2.2μF;1210 ≥10μF;</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603 ≥1μF;0805≥2.2μF;1206 ≥2.2μF;1210 ≥10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201 ≥0.01μF(0201/X5R=0.01μF;0805 ≥1μF;1210 ≥10μF*</td></tr><tr><td>≤14%</td><td>0603 ≥0.33μF</td></tr><tr><td>≤15%</td><td>0201 ≥0.1μF(0201/X5R&gt;0.01μF);0603 ≥0.47μF;TT series<br/>0402 ≥0.10μF(0402/X7R ≥0.056μF);0805 ≥2.2μF;<br/>1206 ≥4.7μF;1210 ≥22μF(1210/X5R ≥10μF)*</td></tr><tr><td>≤20%</td><td>0402 ≥0.33μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10%</td><td>0603 ≥0.15μF;0805 ≥0.68μF;1206 ≥2.2μF;1210 ≥4.7μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤7.5%</td><td>≤15%</td><td>0201 ≥0.01μF(0201/X7R ≥0.022μF);0402 ≥0.033μF;<br/>0603&gt;0.47μF;0805 ≥2.2μF;1206 ≥4.7μF;1210 ≥22μF</td></tr><tr><td>≤15%</td><td>0201 ≥0.012μF;0402 ≥0.22μF (0402/X7R ≥0.15μF);<br/>0603 ≥0.33μF;0805 ≥2.2μF;1206 ≥2.2μF;1210 ≥22μF</td></tr><tr><td>≤20%</td><td>0201 ≥0.1μF;0402 ≥1μF;0603/X5R ≥10μF;01R5/X5R</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201 ≥0.1μF;0402 ≥1μF(0402/X6S ≥0.47μF);<br/>0603 ≥10μF;0805 ≥4.7μF;1206 ≥47μF;1210 ≥100μF</td></tr><tr><td>4V</td><td>≤20%</td><td>--</td><td>--</td></tr></table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω·F whichever is smaller.<br/>Class II (X7R, X5R, X6S, X7S)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">500MΩ or RxC≥5 Ω·F whichever is smaller.</td></tr><tr><td>50V: 0402&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≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr><tr><td>6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr></table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥100V | ≤3% | ≤6% | 1206 ≥0.47μF | ≤7% | 1812 ≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF | ≤7.5% | 0603 ≥0.068μF;0805 > 0.1μF;1206 ≥1μF; 1210 ≥2.2μF | ≤20% | 0805 > 0.22μF;1210 ≥3.3μF | 50V | ≤3% | ≤6% | 0201(50V);0603 ≥0.047μF;0805 ≥0.18μF;1206 ≥0.47μF | ≤7% | 1812 ≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF | ≤10% | 0201 ≥0.01uF; 0402 ≥0.012μF;1210 ≥3.3μF | ≤20% | 0402 ≥0.047μF;0603>0.1μF;0805 ≥1μF(0805/X7R>0.47μF); 1206 ≥2.2μF;1210 ≥10μF; | 35V | ≤5% | ≤20% | 0603 ≥1μF;0805≥2.2μF;1206 ≥2.2μF;1210 ≥10μF | 25V | ≤5% | ≤10% | 0201 ≥0.01μF(0201/X5R=0.01μF;0805 ≥1μF;1210 ≥10μF* | ≤14% | 0603 ≥0.33μF | ≤15% | 0201 ≥0.1μF(0201/X5R>0.01μF);0603 ≥0.47μF;TT series<br>0402 ≥0.10μF(0402/X7R ≥0.056μF);0805 ≥2.2μF;<br>1206 ≥4.7μF;1210 ≥22μF(1210/X5R ≥10μF)* | ≤20% | 0402 ≥0.33μF | 16V | ≤5% | ≤10% | 0603 ≥0.15μF;0805 ≥0.68μF;1206 ≥2.2μF;1210 ≥4.7μF | 10V | ≤7.5% | ≤15% | 0201 ≥0.01μF(0201/X7R ≥0.022μF);0402 ≥0.033μF;<br>0603>0.47μF;0805 ≥2.2μF;1206 ≥4.7μF;1210 ≥22μF | ≤15% | 0201 ≥0.012μF;0402 ≥0.22μF (0402/X7R ≥0.15μF);<br>0603 ≥0.33μF;0805 ≥2.2μF;1206 ≥2.2μF;1210 ≥22μF | ≤20% | 0201 ≥0.1μF;0402 ≥1μF;0603/X5R ≥10μF;01R5/X5R | 6.3V | ≤15% | ≤30% | 0201 ≥0.1μF;0402 ≥1μF(0402/X6S ≥0.47μF);<br>0603 ≥10μF;0805 ≥4.7μF;1206 ≥47μF;1210 ≥100μF | 4V | ≤20% | -- | -- | Rated voltage | Insulation Resistance | 100V: All X7R;1210≥3.3μF | 500MΩ or RxC≥5 Ω·F whichever is smaller. | 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF | 35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF | 25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF | 16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF | 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF | 6.3V ; 4V ; All X6S/X7S items; Size≥1812 |
| Rated vol.                                                              | D.F. ≤                                   | Exception of D.F. ≤                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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                                                                      |     |     |      |                                             |     |     |      |                                                    |      |              |      |                                                                                                                                                |      |              |     |     |      |                                                   |     |       |      |                                                                                                  |      |                                                                                                   |      |                                               |      |      |      |                                                                                           |    |      |    |    |               |                       |                          |                                          |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| ≥100V                                                                   | ≤3%                                      | ≤6%                                                                                                                                                                                                                                                                                                                                                                                                    | 1206 ≥0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                      |     |     |      |                                             |     |     |      |                                                    |      |              |      |                                                                                                                                                |      |              |     |     |      |                                                   |     |       |      |                                                                                                  |      |                                                                                                   |      |                                               |      |      |      |                                                                                           |    |      |    |    |               |                       |                          |                                          |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤7%                                                                                                                                                                                                                                                                                                                                                                                                    | 1812 ≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                           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                                                                      |     |     |      |                                             |     |     |      |                                                    |      |              |      |                                                                                                                                                |      |              |     |     |      |                                                   |     |       |      |                                                                                                  |      |                                                                                                   |      |                                               |      |      |      |                                                                                           |    |      |    |    |               |                       |                          |                                          |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤7.5%                                                                                                                                                                                                                                                                                                                                                                                                  | 0603 ≥0.068μF;0805 > 0.1μF;1206 ≥1μF; 1210 ≥2.2μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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                                                                      |     |     |      |                                             |     |     |      |                                                    |      |              |      |                                                                                                                                                |      |              |     |     |      |                                                   |     |       |      |                                                                                                  |      |                                                                                                   |      |                                               |      |      |      |                                                                                           |    |      |    |    |               |                       |                          |                                          |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤20%                                                                                                                                                                                                                                                                                                                                                                                                   | 0805 > 0.22μF;1210 ≥3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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                                                                      |     |     |      |                                             |     |     |      |                                                    |      |              |      |                                                                                                                                                |      |              |     |     |      |                                                   |     |       |      |                                                                                                  |      |                                                                                                   |      |                                               |      |      |      |                                                                                           |    |      |    |    |               |                       |                          |                                          |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 50V                                                                     | ≤3%                                      | ≤6%                                                                                                                                                                                                                                                                                                                                                                                                    | 0201(50V);0603 ≥0.047μF;0805 ≥0.18μF;1206 ≥0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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                                                                      |     |     |      |                                             |     |     |      |                                                    |      |              |      |                                                                                                                                                |      |              |     |     |      |                                                   |     |       |      |                                                                                                  |      |                                                                                                   |      |                                               |      |      |      |                                                                                           |    |      |    |    |               |                       |                          |                                          |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤7%                                                                                                                                                                                                                                                                                                                                                                                                    | 1812 ≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                           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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤10%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.01uF; 0402 ≥0.012μF;1210 ≥3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤20%                                                                                                                                                                                                                                                                                                                                                                                                   | 0402 ≥0.047μF;0603>0.1μF;0805 ≥1μF(0805/X7R>0.47μF); 1206 ≥2.2μF;1210 ≥10μF;                                                                                                                                                                                                                                                                                                                                                                                                                             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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 35V                                                                     | ≤5%                                      | ≤20%                                                                                                                                                                                                                                                                                                                                                                                                   | 0603 ≥1μF;0805≥2.2μF;1206 ≥2.2μF;1210 ≥10μF                                                                                                                                                                                                                                                                                                                                                                                                                                                              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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 25V                                                                     | ≤5%                                      | ≤10%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.01μF(0201/X5R=0.01μF;0805 ≥1μF;1210 ≥10μF*                                                                                                                                                                                                                                                                                                                                                                                                                                                       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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤14%                                                                                                                                                                                                                                                                                                                                                                                                   | 0603 ≥0.33μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤15%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.1μF(0201/X5R>0.01μF);0603 ≥0.47μF;TT series<br>0402 ≥0.10μF(0402/X7R ≥0.056μF);0805 ≥2.2μF;<br>1206 ≥4.7μF;1210 ≥22μF(1210/X5R ≥10μF)*                                                                                                                                                                                                                                                                                                                                                           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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤20%                                                                                                                                                                                                                                                                                                                                                                                                   | 0402 ≥0.33μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 16V                                                                     | ≤5%                                      | ≤10%                                                                                                                                                                                                                                                                                                                                                                                                   | 0603 ≥0.15μF;0805 ≥0.68μF;1206 ≥2.2μF;1210 ≥4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                        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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 10V                                                                     | ≤7.5%                                    | ≤15%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.01μF(0201/X7R ≥0.022μF);0402 ≥0.033μF;<br>0603>0.47μF;0805 ≥2.2μF;1206 ≥4.7μF;1210 ≥22μF                                                                                                                                                                                                                                                                                                                                                                                                         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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤15%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.012μF;0402 ≥0.22μF (0402/X7R ≥0.15μF);<br>0603 ≥0.33μF;0805 ≥2.2μF;1206 ≥2.2μF;1210 ≥22μF                                                                                                                                                                                                                                                                                                                                                                                                        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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                          | ≤20%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.1μF;0402 ≥1μF;0603/X5R ≥10μF;01R5/X5R                                                                                                                                                                                                                                                                                                                                                                                                                                                            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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 6.3V                                                                    | ≤15%                                     | ≤30%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201 ≥0.1μF;0402 ≥1μF(0402/X6S ≥0.47μF);<br>0603 ≥10μF;0805 ≥4.7μF;1206 ≥47μF;1210 ≥100μF                                                                                                                                                                                                                                                                                                                                                                                                                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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 4V                                                                      | ≤20%                                     | --                                                                                                                                                                                                                                                                                                                                                                                                     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| Rated voltage                                                           | Insulation Resistance                    |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 100V: All X7R;1210≥3.3μF                                                | 500MΩ or RxC≥5 Ω·F whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF                |                                          |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF                           |                                          |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF |                                          |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF    |                                          |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF  |                                          |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
| 6.3V ; 4V ; All X6S/X7S items; Size≥1812                                |                                          |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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|                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |

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

| No                                                                      | Item                                      | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Requirements                                                                                                                                                                                              |               |                       |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |   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-|------|--------|------|------------|---------------|-------------|------|---------|---------|---------|-----|-----------|------|-----------------|-----|----------|--------|----------|------|-----|----------|----------|-----|---------|-----|-----|---------|-----|---------|------|---------------------|---------|---------|------|----------|---------------------|-----|----------|-----|---------|------|-----|--------|---------|------|---------|-----------------|-----|---------|------|---------|------|---------------------|----------|---------|------|-----|------|---------|--|--|------|---------|------|-----|-----------|---------|------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|---------------------|-------|-----|-----------------|---------------------------------------------------|---------------------------------------------------|-----------------------------|-----|-----|----------------------------------------------------|---------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------|-----|-----|-----------------------------------------------|------------------------------------------------------|------------------|---------------------------------------------------|-----|-----|------------------------------------------------|--------------------------------------|------------------|----------------------------------------------------|-----|-----|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|---------------------------------------------|-----|-------|-------------------------------------------------|---------------------------------------------|-------------------------------------------------|---------------------------------------|------|------|------------------------------------------------|----|----|------|-----|---------------|-----------------------|--------------------------|-------------------------------------------|----------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------|
| 15.                                                                     | High Temperature Load<br>(Endurance)      | *Test temp. :<br>NP0, X7R/X7E/X7S: 125±3°C<br>X6S: 105±3°C<br>X5R, 85±3°C<br>*Test time: 1000+24/-0 hrs.<br>*To apply voltage:<br>(1) 100% of rated voltage for below range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | * No remarkable damage.<br>Cap change:<br>NP0: ±3.0% or ±0.3pF whichever is larger<br>X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br>**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25% |               |                       |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |   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|                                                                         |                                           | Q/D.F. value:<br>NP0: More than 30pF, Q≥350<br>10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF, Q≥200+10C<br>X7R, X5R, X6S, X7S:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       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                                           |                                                  |                                             |     |       |                                                 |                                             |                                                 |                                       |      |      |                                                |    |    |      |     |               |                       |                          |                                           |                                                          |                                               |                                                                         |                                                                      |                                                                        |                                          |
|                                                                         |                                           | <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td>01R5</td><td>X5R</td><td>≤10V</td><td>C=0.1μF</td></tr><tr><td rowspan="2">0201</td><td rowspan="2">X5R/X7R/<br/>X6S/X7S</td><td>≤10V</td><td>C≥0.1μF</td></tr><tr><td>≥16V</td><td>C&gt;0.1μF</td></tr><tr><td rowspan="4">0402</td><td rowspan="2">X5R</td><td>≤16V</td><td>C&gt;1.0μF</td></tr><tr><td>25V,50V</td><td>C≥1.0μF</td></tr><tr><td rowspan="2">X6S</td><td>6.3V,10V</td><td>C&gt;1.0μF</td></tr><tr><td>16V,25V</td><td>C≥1.0μF</td></tr><tr><td rowspan="4">0603</td><td rowspan="2">X5R/X7R/<br/>X6S/X7S</td><td>6.3V,10V</td><td>C≥1.0μF</td></tr><tr><td>4V</td><td>C≥22μF</td></tr><tr><td rowspan="2">X5R/X6S/X7S</td><td>6.3V,10V</td><td>C≥4.7μF<sup>#1</sup></td></tr><tr><td>25V</td><td>C≥1.0μF</td></tr><tr><td rowspan="8">0805</td><td rowspan="4">X5R/X7R/<br/>X6S/X7S</td><td>35V</td><td>C≥1.0μF</td></tr><tr><td>4V</td><td>C≥47μF</td></tr><tr><td>6.3V</td><td>C≥22μF</td></tr><tr><td>10V,50V</td><td>C≥10μF</td></tr><tr><td rowspan="2">X6S</td><td>16V</td><td>C&gt;10μF</td></tr><tr><td>25V</td><td>C≥10μF</td></tr><tr><td rowspan="2">X7R/X7S</td><td>16V,25V</td><td>C≥10μF</td></tr><tr><td>X5R</td><td>C≥22μF</td></tr><tr><td>1206</td><td>X5R/X7R/X6S</td><td>≤6.3V</td><td>C≥47μF</td></tr><tr><td>1210</td><td>X5R/X7R/X6S</td><td>16V</td><td>C≥47μF</td></tr><tr><td></td><td>X7R</td><td>100V</td><td>C≥3.3μF</td></tr><tr><td>TT15</td><td>X5R</td><td>6.3V</td><td>C&gt;1.0μF</td></tr><tr><td>TT21</td><td>X5R/X7R/X6S</td><td>≤10V</td><td>C≥10μF</td></tr></table> <p>**1WV items must follow de-rating conditions.<br/>#1. 0603X106/475(10V)&amp;0603S106(4V&amp;6.3V):<br/>150% of rated voltage<br/>(2) 150% of rated voltage for below range.</p> <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td rowspan="2">0201</td><td rowspan="2">X5R/X6S</td><td>16V,25V</td><td>C=0.1μF</td></tr><tr><td>16V</td><td>C≥0.022μF</td></tr><tr><td rowspan="2">0402</td><td rowspan="2">X7R/X5R/<br/>X6S</td><td>50V</td><td>C&gt;0.01μF</td></tr><tr><td>10~25V</td><td>C≥0.22μF</td></tr><tr><td rowspan="4">0603</td><td rowspan="2">X7S</td><td>50V~100V</td><td>C&gt;0.22μF</td></tr><tr><td>50V</td><td>C&gt;0.1μF</td></tr><tr><td rowspan="2">X7R</td><td>25V</td><td>C=1.0μF</td></tr><tr><td>50V</td><td>C≥1.0μF</td></tr><tr><td rowspan="4">0805</td><td rowspan="2">X7R/X5R/<br/>X6S/X7S</td><td>10V,16V</td><td>C≥1.0μF</td></tr><tr><td>100V</td><td>C≥0.47μF</td></tr><tr><td rowspan="2">X5R/X7R/<br/>X6S/X7S</td><td>50V</td><td>C≥0.68μF</td></tr><tr><td>35V</td><td>C≥2.2μF</td></tr><tr><td rowspan="4">1206</td><td rowspan="2">X7R</td><td>10~25V</td><td>C≥4.7μF</td></tr><tr><td>100V</td><td>C≥1.0μF</td></tr><tr><td rowspan="2">X5R/X6S/<br/>X7S</td><td>50V</td><td>C≥2.2μF</td></tr><tr><td>100V</td><td>C&gt;1.0μF</td></tr><tr><td>1210</td><td>X5R/X7R/<br/>X6S/X7S</td><td>50V~100V</td><td>C≥2.2μF</td></tr><tr><td>1812</td><td>X7R</td><td>≤50V</td><td>C≥4.7μF</td></tr><tr><td></td><td></td><td>100V</td><td>C≥1.0μF</td></tr><tr><td>1825</td><td rowspan="3">X7R</td><td rowspan="3">100V~250V</td><td rowspan="3">C≥1.0μF</td></tr><tr><td>2220</td></tr><tr><td>2225</td></tr></table> <p>(3) ≤6.3V or C≥10μF or TT series:150% of rated voltage.<br/>(4) 10V~250V: 200% of rated voltage. Excluding 1812/NP0(250V)/104:100% of rated voltage.<br/>0201/X6S(10V)/393~823:150% of rated voltage.<br/>(5) 400V~450V: 120% of rated voltage.<br/>(6) 500V: 150% of rated voltage.<br/>(7) 630V~3000V: 120% of rated voltage. Excluding<br/>1210/X7R(2kV)/103:110% of rated voltage.<br/>1210/NP0(1kV)/333:100% of rated voltage.<br/>1812/NP0(1kV)/472~562:100% of rated voltage.<br/>(8) Ur=3.5kV &amp; 4kV: 110% of rated voltage.</p> <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> | Size                                                                                                                                                                                                      | Dielectric    | Rated voltage         | Capacitance | 01R5 | X5R | ≤10V | C=0.1μF | 0201 | X5R/X7R/<br>X6S/X7S | ≤10V | C≥0.1μF | ≥16V | C>0.1μF | 0402 | X5R | ≤16V | C>1.0μF | 25V,50V | C≥1.0μF | X6S | 6.3V,10V | C>1.0μF | 16V,25V | C≥1.0μF | 0603 | X5R/X7R/<br>X6S/X7S | 6.3V,10V | C≥1.0μF | 4V | C≥22μF | X5R/X6S/X7S | 6.3V,10V | C≥4.7μF <sup>#1</sup> | 25V | C≥1.0μF | 0805 | X5R/X7R/<br>X6S/X7S | 35V | C≥1.0μF | 4V | C≥47μF | 6.3V | C≥22μF | 10V,50V | C≥10μF | X6S | 16V | C>10μF | 25V | C≥10μF | X7R/X7S | 16V,25V | C≥10μF | X5R | C≥22μF | 1206 | X5R/X7R/X6S | ≤6.3V | C≥47μF | 1210 | X5R/X7R/X6S | 16V | C≥47μF |  | X7R | 100V | C≥3.3μF | TT15 | X5R | 6.3V | C>1.0μF | TT21 | X5R/X7R/X6S | ≤10V | C≥10μF | Size | Dielectric | Rated voltage | Capacitance | 0201 | X5R/X6S | 16V,25V | C=0.1μF | 16V | C≥0.022μF | 0402 | X7R/X5R/<br>X6S | 50V | C>0.01μF | 10~25V | C≥0.22μF | 0603 | X7S | 50V~100V | C>0.22μF | 50V | C>0.1μF | X7R | 25V | C=1.0μF | 50V | C≥1.0μF | 0805 | X7R/X5R/<br>X6S/X7S | 10V,16V | C≥1.0μF | 100V | C≥0.47μF | X5R/X7R/<br>X6S/X7S | 50V | C≥0.68μF | 35V | C≥2.2μF | 1206 | X7R | 10~25V | C≥4.7μF | 100V | C≥1.0μF | X5R/X6S/<br>X7S | 50V | C≥2.2μF | 100V | C>1.0μF | 1210 | X5R/X7R/<br>X6S/X7S | 50V~100V | C≥2.2μF | 1812 | X7R | ≤50V | C≥4.7μF |  |  | 100V | C≥1.0μF | 1825 | X7R | 100V~250V | C≥1.0μF | 2220 | 2225 | <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td rowspan="4">≥100V</td><td rowspan="4">≤3%</td><td>≤6% 1206≥0.47μF</td></tr><tr><td>≤7% 1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤7.5% 0603≥0.068μF;0805&gt;0.1μF;1206≥1μF;1210≥2.2μF</td></tr><tr><td>≤20% 0805&gt;0.22μF;1210≥3.3μF</td></tr><tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6% 0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr><tr><td>≤7% 1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤10% 0201≥0.01μF; 0402≥0.012μF;1210≥3.3μF</td></tr><tr><td>≤20% 0402≥0.047μF;0603&gt;0.1μF;0805≥1μF(0805/X7R&gt;0.47μF); 1206≥2.2μF;1210≥10μF;</td></tr><tr><td rowspan="4">35V</td><td rowspan="4">≤5%</td><td>≤20% 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr><tr><td>≤10% 0201≥0.01μF(0201/X5R=0.01μF;0805≥1μF;1210≥10μF*</td></tr><tr><td>≤14% 0603≥0.33μF</td></tr><tr><td>0201≥0.1μF(0201/X5R&gt;0.01μF);0603≥0.47μF;TT series</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤15% 0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;</td></tr><tr><td>1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*</td></tr><tr><td>≤20% 0402≥0.33μF</td></tr><tr><td>≤10% 0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr><tr><td rowspan="4">16V</td><td rowspan="4">≤5%</td><td>≤15% 0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF;</td></tr><tr><td>0603&gt;0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr><tr><td>≤15% 0201≥0.012μF;0402≥0.22μF (0402/X7R≥0.15μF);</td></tr><tr><td>0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr><tr><td rowspan="4">10V</td><td rowspan="4">≤7.5%</td><td>≤15% 0201≥0.01μF;0402≥0.22μF (0402/X7R≥0.15μF);</td></tr><tr><td>0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr><tr><td>≤20% 0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr><tr><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">≤15%</td><td>≤30% 0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr><tr><td>4V</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td></tr></table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω·F whichever is smaller.<br/>Class II (X7R, X5R, X6S, X7S)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><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 ; All X6S/X7S items; Size≥1812</td></tr></table> <p>** De-rating conditions:</p>  <p>The general MLCC products are designed for use in devices with a typical lifetime around 10 years.<br/>The general MLCC products are designed so that the useful lifetime can be extended longer than 10 years under the following conditions:<br/>「80% of the rated voltage or less, Maximum operating temperature -20 degree C or less」<br/>Extended useful lifetime, under specific operating conditions, can be estimated from the chart.<br/>※ The useful lifetime is the time when cumulative failure rate becomes 1%.<br/>※ Please note that the useful lifetime data is for reference only and not guaranteed.</p> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥100V | ≤3% | ≤6% 1206≥0.47μF | ≤7% 1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF | ≤7.5% 0603≥0.068μF;0805>0.1μF;1206≥1μF;1210≥2.2μF | ≤20% 0805>0.22μF;1210≥3.3μF | 50V | ≤3% | ≤6% 0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF | ≤7% 1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF | ≤10% 0201≥0.01μF; 0402≥0.012μF;1210≥3.3μF | ≤20% 0402≥0.047μF;0603>0.1μF;0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF; | 35V | ≤5% | ≤20% 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF | ≤10% 0201≥0.01μF(0201/X5R=0.01μF;0805≥1μF;1210≥10μF* | ≤14% 0603≥0.33μF | 0201≥0.1μF(0201/X5R>0.01μF);0603≥0.47μF;TT series | 25V | ≤5% | ≤15% 0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF; | 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)* | ≤20% 0402≥0.33μF | ≤10% 0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF | 16V | ≤5% | ≤15% 0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; | 0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF | ≤15% 0201≥0.012μF;0402≥0.22μF (0402/X7R≥0.15μF); | 0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF | 10V | ≤7.5% | ≤15% 0201≥0.01μF;0402≥0.22μF (0402/X7R≥0.15μF); | 0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF | ≤20% 0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R | 0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF); | 6.3V | ≤15% | ≤30% 0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF | 4V | 4V | ≤20% | --- | Rated voltage | Insulation Resistance | 100V: All X7R;1210≥3.3μF | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller. | 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF | 35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF | 25V:0201≥0.1μF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF | 16V: 0201≥0.1μF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF | 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF | 6.3V ; 4V ; All X6S/X7S items; Size≥1812 |
|                                                                         |                                           | Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Dielectric                                                                                                                                                                                                | Rated voltage | Capacitance           |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |         |         |     |           |      |                 |     |          |        |          |      |     |          |          |     |         |     |     |         |     |         |      |                     |         |         |      |          |                     |     |          |     |         |      |     |        |         |      |         |                 |     |         |      |         |      |                     |          |         |      |     |      |         |  |  |      |         |      |     |           |         |      |      |                                                                                                                                                                                                                                                                                                                                                                      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|                                                                         |                                           | 01R5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R                                                                                                                                                                                                       | ≤10V          | C=0.1μF               |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |   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|                                                                         |                                           | 0201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R/X7R/<br>X6S/X7S                                                                                                                                                                                       | ≤10V          | C≥0.1μF               |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |   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                                                                                               |                                                                                                                                                                                                           | ≥16V          | C>0.1μF               |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |   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                                                                                               | X5R                                                                                                                                                                                                       | ≤16V          | C>1.0μF               |             |      |     |      |         |      |                     |      |         |      |         |      |     |      |         |         |         |     |          |         |         |         |      |                     |          |         |    |        |             |          |                       |     |         |      |                     |     |         |    |        |      |        |         |        |     |     |        |     |        |         |         |        |     |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |   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| 16V                                                                     | ≤5%                                       | ≤15% 0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| 100V: All X7R;1210≥3.3μF                                                | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF                |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF                           |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 25V:0201≥0.1μF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 16V: 0201≥0.1μF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF    |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF  |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| 6.3V ; 4V ; All X6S/X7S items; Size≥1812                                |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

## APPENDIXES

### ■ Tape & reel dimensions

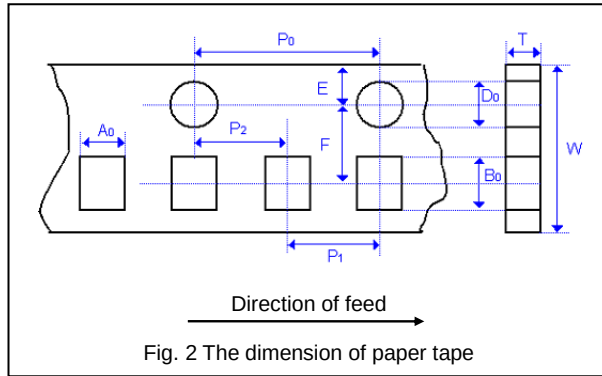


Fig. 2 The dimension of paper tape

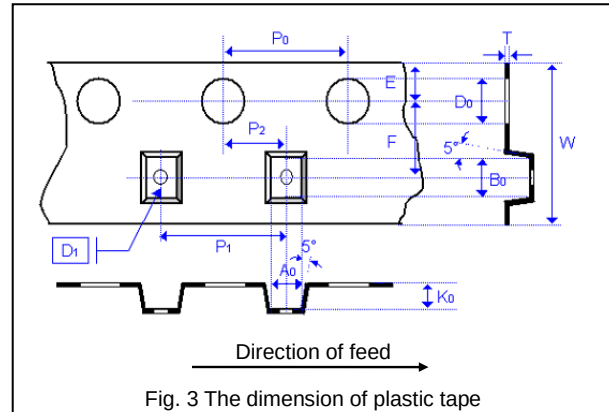


Fig. 3 The dimension of plastic tape

| Size              | 0201             | 0402             | 0603             | 0805             |                  |                  | 1206             |                  |                  | 1210             |                  |                  |                  | 1808             |                  | 1812             |                  |                  |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Thickness         | L                | N,E              | S,H,X            | A,H              | B,T              | D,I              | B,T              | C,J,D            | G,P              | T                | C,D              | G,K              | M                | D,F              | G,K              | D,F              | G,K              | M,U              |
| A <sub>0</sub>    | 0.40<br>+/-0.10  | 0.70<br>+/-0.20  | 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           | < 3.05           | < 3.20           | < 2.50           | < 2.50           | < 3.90           | < 3.90           | < 3.90           |
| B <sub>0</sub>    | 0.70<br>+/-0.10  | 1.20<br>+/-0.20  | 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           | < 3.80           | < 4.00           | < 5.30           | < 5.30           | < 5.30           | < 5.30           | < 5.30           |
| T                 | ≤0.55            | ≤0.80            | ≤1.20            | ≤1.15            | ≤1.20            | 0.23<br>+/-0.1   | ≤1.20            | 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   | 0.23<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   |
| K <sub>0</sub>    | 0.44<br>+/-0.05  | -                | -                | -                | -                | < 2.50           | -                | < 2.50           | < 2.50           | < 1.50           | < 2.00           | < 2.50           | < 3.20           | < 2.50           | < 2.50           | < 2.50           | < 2.50           | < 3.50           |
| W                 | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 |
| P <sub>0</sub>    | 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  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  |
| 10xP <sub>0</sub> | 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 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 |
| P <sub>1</sub>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  |
| P <sub>2</sub>    | 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>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  |
| D <sub>0</sub>    | 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  | 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  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  |
| D <sub>1</sub>    | -                | -                | -                | -                | -                | 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  | 1.00<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  |
| E                 | 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  | 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  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  |
| F                 | 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  | 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  |

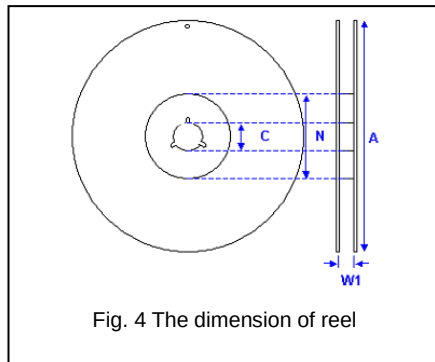
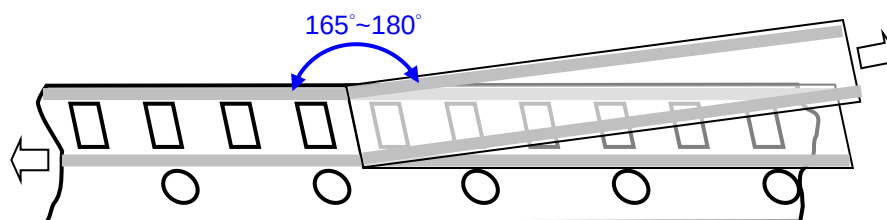


Fig. 4 The dimension of reel

| Size           | 0201, 0402, 0603, 0805, 1206, 1210 |           |           | 1812        |
|----------------|------------------------------------|-----------|-----------|-------------|
| Reel size      | 7"                                 | 10"       | 13"       | 7"          |
| C              | 13.0±0.5                           | 13.0±0.5  | 13.0±0.5  | 13.0±0.5    |
| W <sub>1</sub> | 10.0±1.5                           | 10.0±1.5  | 10.0±1.5  | 12.4±2.0/-0 |
| A              | 178.0±2.0                          | 250.0±2.0 | 330.0±2.0 | 178.0±2.0   |
| N              | 60.0±1.0/-0                        | 50 min    | 50 min    | 60.0±1.0/-0 |

### ■ Peeling force (EIA-481)

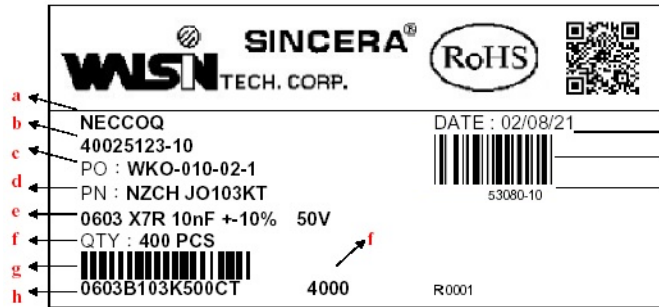
Peel-off force should be in the range of 10 grams to 100 grams at a peel-off speed of 300±10 mm/min.





## Multilayer Ceramic Capacitors

### Example of customer label

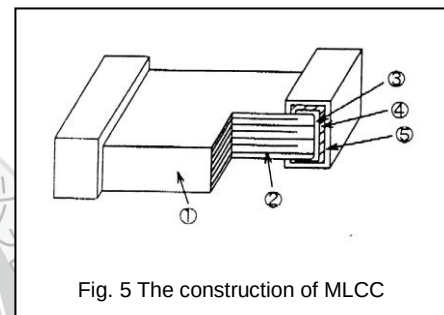


\*Customized label is available upon request

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

### Constructions

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



### Storage and handling conditions

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

#### Cautions:

- 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.)
- In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.



## Multilayer Ceramic Capacitors

### ■ Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N<sub>2</sub> within oven are recommended.

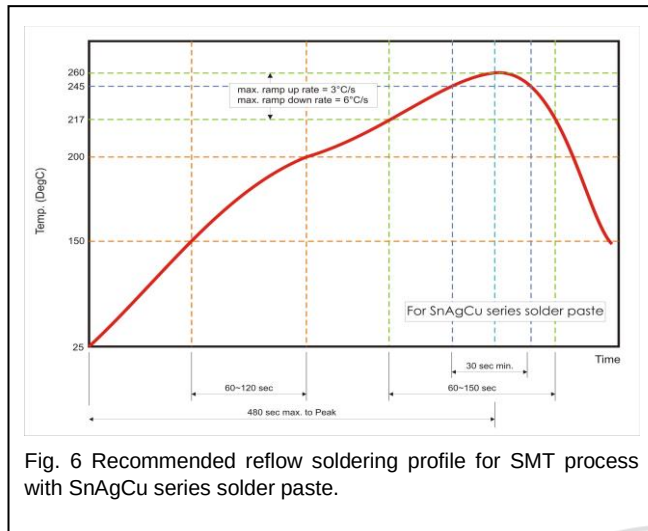


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

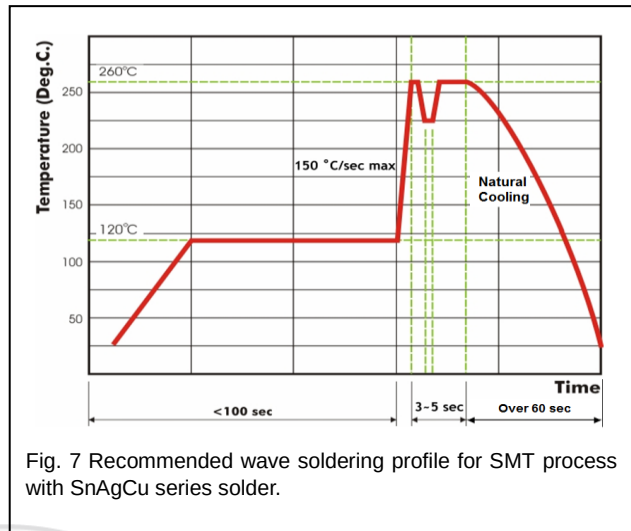


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



# Mouser Electronics

Authorized Distributor

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|                                |                                |                                |                                |                                |                                |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| <a href="#">0402N1R2C500LT</a> | <a href="#">0402N1R5C500LT</a> | <a href="#">0402N3R3C500LT</a> | <a href="#">0402N4R7C500LT</a> | <a href="#">0402N5R6C500LT</a> | <a href="#">0402N220G500LT</a> |
| <a href="#">0402N470G500LT</a> | <a href="#">0402N151J500LT</a> | <a href="#">0603N1R0C500LT</a> | <a href="#">0603N330G500LT</a> | <a href="#">0603N120J500LT</a> | <a href="#">0603N180J500LT</a> |
| <a href="#">0603N101J500LT</a> | <a href="#">0402B471K500CT</a> | <a href="#">0402B102K500CT</a> | <a href="#">0402B152K500CT</a> | <a href="#">0402B222K500CT</a> | <a href="#">0402B392K500CT</a> |
| <a href="#">0402B103K500CT</a> | <a href="#">0402B103K250CT</a> | <a href="#">0402B103K160CT</a> | <a href="#">0402B123K160CT</a> | <a href="#">0603B103K500CT</a> | <a href="#">0402X104K160CT</a> |
| <a href="#">0402N101J500CT</a> | <a href="#">0402N150J500CT</a> | <a href="#">0402N330J500CT</a> | <a href="#">0402N8R0D500LT</a> | <a href="#">0402N2R2C500LT</a> | <a href="#">0402N100J500LT</a> |
| <a href="#">0402N330J500LT</a> | <a href="#">0402X106M6R3CT</a> | <a href="#">0402N5R6C500CT</a> | <a href="#">0603N1R0C500CT</a> | <a href="#">0402N100J500CT</a> | <a href="#">0603N150F500CT</a> |
| <a href="#">0402N220G500CT</a> | <a href="#">0603N120J500CT</a> | <a href="#">0402N2R2C500CT</a> | <a href="#">0402X105K100CT</a> | <a href="#">1206B104K500CT</a> | <a href="#">1206B105K500CT</a> |
| <a href="#">1206B103K500CT</a> | <a href="#">0805B102K500CT</a> | <a href="#">1206B475K250CT</a> | <a href="#">0603N510F500LT</a> | <a href="#">0603N180J500CT</a> | <a href="#">0603B682K500CT</a> |
| <a href="#">0603B393K500CT</a> | <a href="#">0603B104K160CT</a> | <a href="#">0402B333K100CT</a> | <a href="#">0402N0R5B500CT</a> | <a href="#">0402N120F500CT</a> | <a href="#">0402B473K500CT</a> |
| <a href="#">0201X223K6R3CT</a> | <a href="#">0402N271J500CT</a> | <a href="#">0603B202K500CT</a> | <a href="#">0603N511J500CT</a> | <a href="#">0603N680J500CT</a> | <a href="#">0201N180J500CT</a> |
| <a href="#">0603B104J250CT</a> | <a href="#">0603B333K160CT</a> | <a href="#">0805B333K500CT</a> | <a href="#">0805B333J500CT</a> | <a href="#">1206B223K500CT</a> | <a href="#">0201B101K250CT</a> |
| <a href="#">0603N390J500CT</a> | <a href="#">0603N5R0C500CT</a> | <a href="#">0603N681J500CT</a> | <a href="#">0402B681K500CT</a> | <a href="#">0402B104J160CT</a> | <a href="#">0603B472K160CT</a> |
| <a href="#">1206B222K500CT</a> | <a href="#">1210B104K500CT</a> | <a href="#">0201B222K160CT</a> | <a href="#">0402N100J250CT</a> | <a href="#">0603N121J500CT</a> | <a href="#">0603N180J101CT</a> |
| <a href="#">0603N220J500CT</a> | <a href="#">0402B561K500CT</a> | <a href="#">0603B152K500CT</a> | <a href="#">0603B273K500CT</a> | <a href="#">0603B183J500CT</a> | <a href="#">0603B183K500CT</a> |
| <a href="#">0603B223K500CT</a> | <a href="#">0603B473J500CT</a> | <a href="#">0402B104K100CT</a> | <a href="#">0402N2R4C500CT</a> | <a href="#">0402N3R3C500CT</a> | <a href="#">0603N751J500CT</a> |
| <a href="#">0805N222J500CT</a> | <a href="#">0805N682J500CT</a> | <a href="#">0402B391K500CT</a> | <a href="#">0402B822K250CT</a> | <a href="#">0603B392K500CT</a> | <a href="#">1206B472K500CT</a> |
| <a href="#">0201B472K100CT</a> | <a href="#">0402N3R0B500CT</a> | <a href="#">0603N180F500CT</a> | <a href="#">0603N330F500CT</a> |                                |                                |