



**THE DATASHEET OF  
0402N220G500CT**



# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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

**Multilayer Ceramic Capacitors**

**1. DESCRIPTION**

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

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

**2. FEATURES**

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

**3. APPLICATIONS**

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

**4. HOW TO ORDER**

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

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**5. EXTERNAL DIMENSIONS**

| Outline   | Size Inch (mm)                            | L (mm)   | W (mm)                  | T (mm)/Symbol          | Soldering 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                         |
|   | 0402 (1005)                               | 1.00±0.05                                      | 0.50±0.05               | 0.50±0.05              | N                  | R                                      |  |
|   |   |  |                         | 0.50±0.02/-0.05        | Q                  | R                                      |  |
|   | 0603 (1608)                               | 1.60±0.15/-0.10                                | 0.80±0.15/-0.10         | 0.80±0.07              | S                  | R / W                                  | 0.40±0.15                              |
|   |   |  |                         | 0.50±0.10              | H                  | R / W                                  |  |
|   |   |  |                         | 0.80±0.15/-0.10        | X                  | R / W                                  |  |
|   | 0805 (2012)                               | 2.00±0.15                                      | 1.25±0.10               | 0.50±0.10              | H                  | R / W                                  | 0.50±0.20                              |
|   |   |  |                         | 0.60±0.10              | A                  | R / W                                  |  |
|   |   |  |                         | 0.80±0.10              | B                  | R / W                                  |  |
|   |   |  |                         | 1.25±0.10              | D                  | R                                      |  |
|   |   |  |                         | 0.85±0.10              | T                  | R / W                                  |  |
|   | 1206 (3216)                               | 3.20±0.15                                      | 1.60±0.15               | 0.80±0.10              | B                  | R / W                                  | 0.60±0.20<br>(0.5±0.25) <sup>***</sup> |
|   |   |  |                         | 0.95±0.10              | C                  | R                                      |  |
|   |   |  |                         | 1.25±0.10              | D                  | R                                      |  |
|   |   | 1.15±0.15                                      | J                       | R                      |                    |  |  |
|   |   | 3.20±0.20                                      | 1.60±0.20               | 1.60±0.20              | G                  | R                                      |  |
|   |   | 3.20+0.30/-0.1<br>3.30+0.30/-0.1 <sup>#5</sup> | 1.60+0.30/-0.10         | 1.60+0.30/-0.10        | P                  | R                                      |  |
|   | 1210 (3225)                               | 3.20±0.30                                      | 2.50±0.20               | 0.95±0.10              | C                  | R                                      | 0.75±0.25                              |
| 0.85±0.10   |   |  |                         | T                      | R                  |  |  |
| 1.25±0.10   |   |  |                         | D                      | R                  |  |  |
| 1.60±0.20   |   | G  | R                       |                        |                    |  |  |
| 3.20±0.40   |   | 2.50±0.30                                      | 2.00±0.20               | K                      | R                  |  |  |
| 3.20±0.60 <sup>#4</sup>   |   | 2.50±0.50 <sup>#4</sup>                        | 2.50±0.50 <sup>#4</sup> | M                      | R                  |  |  |
| 1808 (4520)   | 4.50±0.40<br>(4.5+0.5/-0.3) <sup>**</sup> | 2.03±0.25                                      | 1.25±0.10               | D                      | R                  | 0.75±0.25<br>(0.5±0.25) <sup>***</sup> |  |
|   |   |  | 1.40±0.15               | F                      | R                  |  |  |
|   |   |  | 1.60±0.20               | G                      | R                  |  |  |
|   |   |  | 2.00±0.20               | K                      | R                  |  |  |
| 1812 (4532)   | 4.50±0.40<br>(4.5+0.5/-0.3) <sup>**</sup> | 3.20±0.30                                      | 1.25±0.10               | D                      | R                  | 0.75±0.25<br>(0.5±0.25) <sup>***</sup> |  |
|   |   |  | 1.60±0.20               | G                      | R                  |  |  |
|   |   |  | 2.00±0.20               | K                      | R                  |  |  |
|   |   | 3.20±0.40                                      | 2.50±0.30               | 2.50±0.30              | M                  |  | R                                      |
|   |   |  |                         | 2.80±0.30              | U                  |  | R                                      |

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

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

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

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

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

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

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

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

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

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**6. GENERAL ELECTRICAL DATA**

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

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

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

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature  
X7R/X6S/X5R/X7S: Please refer to page 13 "Reliability test conditions and requirements" for detail.

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



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**7. CAPACITANCE RANGE**

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

| DIELECTRIC    | NPO                 |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |
|---------------|---------------------|------|----|----|----|-----|------|----|----|----|-----|------|----|----|----|-----|------|----|----|----|-----|
|               | SIZE                | 0201 |    |    |    |     | 0402 |    |    |    |     | 0603 |    |    |    |     | 0805 |    |    |    |     |
|               | RATED VOLTAGE (VDC) | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 |
| 0.1pF (0R1)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  |    |     |      |    |    |    |     |      |    |    |    |     |
| 0.2pF (0R2)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  |    |     |      |    |    |    |     |      |    |    |    |     |
| 0.3pF (0R3)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  |    | S   | S    | S  | S  |    |     |      |    |    |    |     |
| 0.4pF (0R4)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  |    | S   | S    | S  | S  |    |     |      |    |    |    |     |
| 0.5pF (0R5)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 0.6pF (0R6)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 0.7pF (0R7)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 0.8pF (0R8)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 0.9pF (0R9)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 1.0pF (1R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 1.2pF (1R2)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 1.5pF (1R5)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 1.8pF (1R8)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 2.0pF (2R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 2.2pF (2R2)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 2.7pF (2R7)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 3.0pF (3R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 3.3pF (3R3)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 3.9pF (3R9)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 4.0pF (4R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 4.7pF (4R7)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 5.0pF (5R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 5.6pF (5R6)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 6.0pF (6R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 6.8pF (6R8)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 7.0pF (7R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 8.0pF (8R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 8.2pF (8R2)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 9.0pF (9R0)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 10pF (100)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 12pF (120)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 15pF (150)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 18pF (180)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 22pF (220)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 27pF (270)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 33pF (330)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 39pF (390)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 47pF (470)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 56pF (560)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 68pF (680)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 82pF (820)    | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 100pF (101)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 120pF (121)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 150pF (151)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 180pF (181)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 220pF (221)   | L                   | L    | L  | L  | L  | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | A   | A    | A  | A  | A  |     |
| 270pF (271)   | L                   | 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)   |                     |      |    |    |    | N   | N    | N  | N  |    | S   | S    | S  | S  | S  | B   | B    | B  | B  | B  |     |
| 1,000pF (102) |                     |      |    |    |    | N   | N    | N  | N  |    | S   | S    | S  | S  | S  | B   | B    | B  | B  | B  |     |
| 1,200pF (122) |                     |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  | X  | B   | B    | B  | B  | B  |     |
| 1,500pF (152) |                     |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  | X  | B   | B    | B  | B  | B  |     |
| 1,800pF (182) |                     |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  | X  | B   | B    | B  | B  | B  |     |
| 2,200pF (222) |                     |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  | 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  | P  | K   | K    | K  | K  | K  | M   | M    | M  | M  |     |  |
| 0.047μF (473)       | P             | P    | P  | P  | P  | K   | K    | K  | K  | K  | M   | M    | M  | M  |     |  |
| 0.056μF (563)       | P             | P    | P  | P  | P  |     |      |    |    |    | M   | M    | M  | M  |     |  |
| 0.068μF (683)       | P             | P    | P  | P  | P  |     |      |    |    |    | M   | M    | M  | M  |     |  |
| 0.082μF (823)       | P             | P    | P  | P  | P  |     |      |    |    |    | M   | M    | M  | M  |     |  |
| 0.1μF (104)         | P             | P    | P  | P  | P  |     |      |    |    |    | M   | M    | M  | M  |     |  |

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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

7-2. 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    |     | 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  | N    |     | S  | S  | S  | S  | S    |     | B  | B  | B  |    | B  | B   |   |
|                     | 8,200pF (822) | L    | L  | L  |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | S    |     | B  | B  | B  |    | B  | B   |   |
|                     | 0.010μF (103) | L    | L  | L  | L  |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | S    |     | B  | B  | B  |    | B  | B   |   |
|                     | 0.012μF (123) |      |    |    |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    |     | B  | B  | B  |    | B  | B   |   |
|                     | 0.015μF (153) |      |    |    |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    |     | B  | B  | B  |    | B  | B   |   |
|                     | 0.018μF (183) |      |    |    |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    |     | B  | B  | B  |    | B  | B   |   |
|                     | 0.022μF (223) |      | L  | L  |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    |     | B  | B  | B  |    | B  | B   |   |
|                     | 0.027μF (273) |      |    |    |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    |     | B  | B  | B  |    | B  | D   |   |
|                     | 0.033μF (333) |      |    |    |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    | X   |    | B  | B  | B  |    | B   | D |
|                     | 0.039μF (393) |      |    |    |    |    |      | N  | N  | N  | N  | N    |     | S  | S  | S  | S  | X    | X   |    | B  | B  | B  |    | B   | D |
| 0.047μF (473)       |               |      |    |    |    |    | N    | N  | N  | N  | N  |      | S   | S  | S  | S  | X  | X    |     | B  | B  | B  |    | B  | D   |   |
| 0.056μF (563)       |               |      |    |    |    |    | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X  |      | B   | B  | B  |    | B  | D  |     |   |
| 0.068μF (683)       |               |      |    |    |    |    | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X  |      | B   | B  | B  |    | B  | D  |     |   |
| 0.082μF (823)       |               |      |    |    |    |    | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X  |      | B   | B  | B  |    | B  | D  |     |   |
| 0.10μF (104)        |               |      |    |    |    |    | N    | N  | N  | E  |    |      | S   | S  | S  | X  | X  |      | B   | B  | B  |    | B  | D  |     |   |
| 0.12μF (124)        |               |      |    |    |    |    |      |    |    |    |    |      | S   | S  | X  |    |    |      | B   | B  | B  |    | B  | I  |     |   |
| 0.15μF (154)        |               |      |    |    |    |    |      | N  |    |    |    |      | S   | S  | X  | X  |    |      | D   | D  | D  |    | D  | I  |     |   |
| 0.18μF (184)        |               |      |    |    |    |    |      |    |    |    |    |      | S   | S  | X  |    |    |      | D   | D  | D  |    | D  | I  |     |   |
| 0.22μF (224)        |               |      |    |    |    |    | N    | N  | N  | N  |    |      | S   | S  | X  | X  |    |      | D   | D  | D  |    | D  | I  |     |   |
| 0.27μF (274)        |               |      |    |    |    |    |      |    |    |    |    |      | X   | X  | X  | X  |    |      | D   | D  | D  |    | I  | I  |     |   |
| 0.33μF (334)        |               |      |    |    |    |    | N    | N  |    |    |    |      | 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  |    |      | 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  | I  |     |   |
| 3.3μF (335)         |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |      |     |    |    |    |    |    |     |   |
| 4.7μF (475)         |               |      |    |    |    |    |      |    |    |    |    |      | X   |    |    |    |    |      | I   | I  | I  | I  |    |    |     |   |
| 6.8μF (685)         |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |      | I   | I  | I* |    |    |    |     |   |
| 10μF (106)          |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |      | I   | I  | I* |    |    |    |     |   |
| 22μF (226)          |               |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |      |     |    |    |    |    |    |     |   |

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

Multilayer Ceramic Capacitors

Approval Sheet

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

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

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

Multilayer Ceramic Capacitors

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

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

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

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

Multilayer Ceramic Capacitors

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

| Dielectric          |              | X6S  |     |    |    |    |      |    |    |    |   |      |    |    |    |   |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |  |
|---------------------|--------------|------|-----|----|----|----|------|----|----|----|---|------|----|----|----|---|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|--|
| Size                |              | 0201 |     |    |    |    | 0402 |    |    |    |   | 0603 |    |    |    |   | 0805 |    |    |    |    | 1206 |    |    |    |    | 1210 |    |    |    |    |  |
| Rated Voltage (VDC) |              | 4    | 6.3 | 10 | 16 | 25 | 6.3  | 10 | 16 | 25 | 4 | 6.3  | 10 | 16 | 25 | 4 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 |  |
| Capacitance         | 0.10μF (104) | L    | L   | L  | L  | L  | N    |    |    |    |   |      |    |    |    |   |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |  |
|                     | 0.15μF (154) |      |     |    |    |    |      |    |    |    |   |      |    |    |    |   |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |  |
|                     | 0.22μF (224) |      | L   | L* |    |    | N    |    |    |    |   |      |    |    |    |   |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |  |
|                     | 0.33μF (334) |      |     |    |    |    | 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  |      |    |    |    |    |  |
|                     | 6.8μF (685)  |      |     |    |    |    |      |    |    |    |   |      |    |    |    |   |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |  |
|                     | 10μF (106)   |      |     |    |    |    | E*   |    |    |    |   | X*   | X* | X* | X* |   |      | I  | I  | I  | I  | I    |    |    |    |    |      |    |    |    |    |  |
|                     | 22μF (226)   |      |     |    |    |    |      |    |    |    |   | X*   | X* |    |    |   |      | I* | I* | I* | I* |      |    |    |    |    |      |    |    |    |    |  |
| 47μF (476)          |              |      |     |    |    |    |      |    |    |    |   |      |    |    |    |   | I*   | I* |    |    |    |      |    |    |    |    |      |    |    |    |    |  |
| 100μF (107)         |              |      |     |    |    |    |      |    |    |    |   |      |    |    |    |   |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |  |

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

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

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

**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     | -        | -            | -        |
| 0603 (1608)     | 0.50±0.10             | H | 4,000      | -        | -            | -        |
|                 | 0.80±0.07             | S | 4,000      | 15,000   | -            | -        |
|                 | 0.80+0.15/-0.10       | X | 4,000      | 15,000   | -            | -        |
| 0805 (2012)     | 0.50±0.10             | H | 4,000      | 15,000   | -            | -        |
|                 | 0.60±0.10             | A | 4,000      | 15,000   | -            | -        |
|                 | 0.80±0.10             | B | 4,000      | 15,000   | -            | -        |
|                 | 0.85±0.10             | T | 4,000      | 15,000   | -            | -        |
|                 | 1.25±0.10             | D | -          | -        | 3,000        | 10,000   |
| 1.25±0.20       | I                     | - | -          | 3,000    | 10,000       |          |
| 1206 (3216)     | 0.80±0.10             | B | 4,000      | 15,000   | -            | -        |
|                 | 0.85±0.10             | T | 4,000      | 15,000   | -            | -        |
|                 | 0.95±0.10             | C | -          | -        | 3,000        | 10,000   |
|                 | 1.15±0.15             | J | -          | -        | 3,000        | 10,000   |
|                 | 1.25±0.10             | D | -          | -        | 3,000        | 10,000   |
|                 | 1.60±0.20             | G | -          | -        | 2,000        | 10,000   |
| 1.60+0.30/-0.10 | P                     | - | -          | 2,000    | 9,000        |          |
| 1210 (3225)     | 0.85±0.10             | T | -          | -        | 3,000        | 10,000   |
|                 | 0.95±0.10             | C | -          | -        | 3,000        | 10,000   |
|                 | 1.25±0.10             | D | -          | -        | 3,000        | 10,000   |
|                 | 1.60±0.20             | G | -          | -        | 2,000        | -        |
|                 | 2.00±0.20             | K | -          | -        | 1,000        | 6,000    |
| 2.50±0.30       | M                     | - | -          | 1,000    | 6,000        |          |
| 1808 (4520)     | 1.25±0.10             | D | -          | -        | 2,000        | 10,000   |
|                 | 1.40±0.15             | F | -          | -        | 2,000        | 10,000   |
|                 | 1.60±0.20             | G | -          | -        | 2,000        | 8,000    |
|                 | 2.00±0.20             | K | -          | -        | 1,000        | 6,000    |
| 1812 (4532)     | 1.25±0.10             | D | -          | -        | 1,000        | 5,000    |
|                 | 1.60±0.20             | G | -          | -        | 1,000        | -        |
|                 | 2.00±0.20             | K | -          | -        | 1,000        | -        |
|                 | 2.50±0.30             | M | -          | -        | 500          | 3,000    |
|                 | 2.80±0.30             | U | -          | -        | 500          | -        |

Unit: pieces

Multilayer Ceramic Capacitors

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.  | Item                            | Test Condition   | Requirements   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|--|---------------------------------|--|--|------------|--------|---------------------|---------------|--------|--|---------------|-----------------------------|---|---|---|--------|-----------------------------|-----------------------------|--------|--|---|-----------|---|---|-----------------------------|--------|--|---|--------|-------------------------|---|---------------|--|--|---------------|--------|--|-------------------------|--------|---|---------------|--|---------------|----------------------|---|--------|---|---|---------|----------------------|---|---|--------------------------|--|--|-------|--------------|-----------|-------|-------------------------------------|---|--|--------------------------|--------------|--|-------|--------------|--|-------|--------------|--------------|---------------------------------------|--------------|--------------|---------------------------------------|-------|--------------|-----|-------|-----|-----|-----|-----|-----|
| 1.   | Visual and Mechanical           | ---  | * No remarkable defect.<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#1:<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. | NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C<br>X7R:   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 |  | <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="4">≥ 100V</td> <td rowspan="4">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5%</td> <td>1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td> </tr> <tr> <td>≤ 5%</td> <td>0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;</td> </tr> <tr> <td>≤ 10%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="4">50V</td> <td rowspan="4">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5%</td> <td>1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603&gt;0.1μF; 0805/X7R&gt;0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">35V</td> <td rowspan="4">≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 3.5%</td> <td>≤ 10%</td> <td>0402 ≥ 0.33μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 0.33μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603&gt;0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="4">16V</td> <td rowspan="4">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td rowspan="4">10V</td> <td rowspan="4">≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 &gt; 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td rowspan="4">6.3V</td> <td rowspan="4">≤ 10%</td> <td>≤ 15%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 &gt; 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td rowspan="4">4V</td> <td rowspan="4">≤ 15%</td> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> </tbody> </table> | 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 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 10%  | 0402 ≥ 0.012μF; 0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V   | ≤ 3.5% | ≤ 10%                   | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5%          | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 7%   | 0603 ≥ 0.33μF | ≤ 10%  | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | 25V                     | ≤ 3.5% | ≤ 10%   | 0402 ≥ 0.33μF | ≤ 12.5%  | 0402 ≥ 0.33μF | ≤ 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 ≥ 0.15μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | 16V   | ≤ 3.5%  | ≤ 10%                | 0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 15%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF | ≤ 5%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 20% | 0402 ≥ 2.2μF | 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 | ≤ 5%         | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 20% | 0402 ≥ 2.2μF | 6.3V   | ≤ 10% | ≤ 15%        | 0402 ≥ 2.2μF | ≤ 20%                                 | 0402 ≥ 2.2μF | ≤ 15%        | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF | ≤ 20% | 0402 ≥ 2.2μF | 4V  | ≤ 15% | --- | --- | --- | --- | --- |
| 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 ≥ 0.01μF; 1210 ≥ 3.3μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0402 ≥ 0.012μF; 0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 35V  | ≤ 3.5%                          | ≤ 10%  | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 7%   | 0603 ≥ 0.33μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 25V  | ≤ 3.5%                          | ≤ 10%  | 0402 ≥ 0.33μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 12.5%  | 0402 ≥ 0.33μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 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 ≥ 0.15μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 16V  | ≤ 3.5%                          | ≤ 10%  | 0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 15%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 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   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 6.3V   | ≤ 10%                           | ≤ 15%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 15%  | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 4V   | ≤ 15%                           | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="4">≥ 100V</td> <td rowspan="4">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 10%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td rowspan="4">50V</td> <td rowspan="4">≤ 2.5%</td> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603&gt;0.1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>1206=10μF</td> </tr> <tr> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">35V</td> <td rowspan="4">≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201=0.01μF; 0805 ≥ 1μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201&gt;0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 3.5%</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.33μF;0805=10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201=0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201&gt;0.01μF; 0402 ≥ 0.22μF; 0603&gt;0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 1μF;0805=10μF</td> </tr> <tr> <td rowspan="4">16V</td> <td rowspan="4">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603&gt;0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 1μF;0805=10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201=0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201&gt;0.01μF; 0402 ≥ 0.22μF; 0603&gt;0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; 01R5/X5R</td> </tr> <tr> <td rowspan="4">10V</td> <td rowspan="4">≤ 5%</td> <td>≤ 12.5%</td> <td>0805=10μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201&gt;0.1μF; 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0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | 50V   | ≤ 2.5% | ≤ 5%                        | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 10%  | 0402 ≥ 0.012μF; 0603>0.1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 12.5%   | 1206=10μF | ≤ 10%   | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V                         | ≤ 3.5% | ≤ 10%  | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5%   | 0201=0.01μF; 0805 ≥ 1μF | ≤ 7%  | 0603 ≥ 0.33μF | ≤ 10%                                  | 0201>0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF | 25V           | ≤ 3.5% | ≤ 12.5%  | 0402 ≥ 0.33μF;0805=10μF | ≤ 5%   | 0201=0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | ≤ 10%         | 0201>0.01μF; 0402 ≥ 0.22μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5%       | 0402 ≥ 1μF;0805=10μF | 16V   | ≤ 3.5% | ≤ 10%   | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% | 0402 ≥ 1μF;0805=10μF | ≤ 5%  | 0201=0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | ≤ 10%                    | 0201>0.01μF; 0402 ≥ 0.22μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; 01R5/X5R | 10V  | ≤ 5%  | ≤ 12.5%      | 0805=10μF | ≤ 15% | 0201>0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF | ≤ 5%  | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 20%                    | 0402 ≥ 2.2μF | 6.3V   | ≤ 10% | ≤ 15%        | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 20% | 0402 ≥ 2.2μF | ≤ 15%        | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF | ≤ 20%        | 0402 ≥ 2.2μF | 4V                                    | ≤ 15% | ---          | --- | ---   | --- | --- | --- | --- | --- |
| Rated vol.   | D.F. ≤                          | Exception of D.F. ≤  |  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| ≥ 100V   | ≤ 2.5%                          | ≤ 3%   | 1206 ≥ 0.47μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0805 > 0.22μF; 1210 ≥ 3.3μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 3%   | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 50V  | ≤ 2.5%                          | ≤ 5%   | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0402 ≥ 0.012μF; 0603>0.1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 12.5%  | 1206=10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 35V  | ≤ 3.5%                          | ≤ 10%  | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201=0.01μF; 0805 ≥ 1μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 7%   | 0603 ≥ 0.33μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0201>0.01μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 25V  | ≤ 3.5%                          | ≤ 12.5%  | 0402 ≥ 0.33μF;0805=10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201=0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0201>0.01μF; 0402 ≥ 0.22μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 12.5%  | 0402 ≥ 1μF;0805=10μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 16V  | ≤ 3.5%                          | ≤ 10%  | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 12.5%  | 0402 ≥ 1μF;0805=10μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201=0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 10%  | 0201>0.01μF; 0402 ≥ 0.22μF; 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; 01R5/X5R   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 10V  | ≤ 5%                            | ≤ 12.5%  | 0805=10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 15%  | 0201>0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 5%   | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 6.3V   | ≤ 10%                           | ≤ 15%  | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 15%  | 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ≤ 20%  | 0402 ≥ 2.2μF   |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
| 4V   | ≤ 15%                           | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |
|  |                                 | ---  | ---  |            |        |                     |               |        |  |               |                             |   |   |   |        |                             |                             |        |  |   |           |   |   |                             |        |  |   |        |                         |   |               |  |  |               |        |  |                         |        |   |               |  |               |                      |   |        |   |   |         |                      |   |   |                          |  |  |       |              |           |       |                                     |   |  |                          |              |  |       |              |  |       |              |              |                                       |              |              |                                       |       |              |     |       |     |     |     |     |     |

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

Multilayer Ceramic Capacitors

| No.  | Item   | Test Condition  | Requirements  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|--|--|---|---|--------------|--------------------------|--|------------|-------------|--------------------------|-------------|--------------|------------|-----------------------|------------|--|-------------|---|-----|--------------|------------|---|------------|--|-------------|--|-----|--------------|-------------|--|-----|--------------|------------|--|------------|-----------------------|-------------|--|-----|--------------|---------------|---|------------|--|-------------|---|-----|------------|---------------|--------------------------------------|-------------|--|-------------|---|------|-------------|-------------|--|----|-------------|-------------|----------------------|-----|--|--|-----|------|--|--|------------|-------------|--------------------------|--|-------------|--------------|------------|-----------------------|------------|--|-------------|---|-----|--------------|------------|---|------------|--|-------------|--|-----|--------------|-------------|--|-----|--------------|------------|--|------------|-----------------------|-------------|--|-----|--------------|---------------|-----------------------|------------|--|-------------|---|-----|------------|---------------|--------------------------------------|-------------|--|-------------|---|------|-------------|-------------|---|----|-------------|-------------|----------------------|-----|--|--|-----|
| 4.   | Dielectric Strength  | * To apply voltage ( $\leq 100V$ ) 250%.<br>* Duration: 1 to 5 sec.<br>* Charge and discharge current less than 50mA. | <table border="1"> <thead> <tr> <th colspan="3">X6S:</th> </tr> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th>Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td rowspan="3"><math>\geq 100V</math></td> <td rowspan="3"><math>\leq 2.5\%</math></td> <td><math>\leq 3\%</math></td> <td>1206 <math>\geq 0.47\mu F</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td>0603 <math>\geq 0.068\mu F</math>; 0805 <math>&gt; 0.1\mu F</math>; 1206 <math>\geq 1\mu F</math>; 1210 <math>\geq 2.2\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0805 <math>&gt; 0.22\mu F</math>; 1210 <math>\geq 3.3\mu F</math></td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3"><math>\leq 2.5\%</math></td> <td><math>\leq 3\%</math></td> <td>0201(50V); 0603 <math>\geq 0.047\mu F</math>; 0805 <math>\geq 0.18\mu F</math>; 1206 <math>\geq 0.47\mu F</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td>0201 <math>\geq 0.01\mu F</math>; 1210 <math>\geq 3.3\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0402 <math>\geq 0.012\mu F</math>; 0603 <math>&gt; 0.1\mu F</math>; 0805 <math>\geq 1\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td>35V</td> <td><math>\leq 3.5\%</math></td> <td><math>\leq 10\%</math></td> <td>0603 <math>\geq 1\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3"><math>\leq 3.5\%</math></td> <td><math>\leq 5\%</math></td> <td>0201 <math>\geq 0.01\mu F</math>; 0805 <math>\geq 1\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td><math>\leq 7\%</math></td> <td>0603 <math>\geq 0.33\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 0.10\mu F</math>; 0603 <math>\geq 0.47\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 4.7\mu F</math>; 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3"><math>\leq 3.5\%</math></td> <td><math>\leq 12.5\%</math></td> <td>0402 <math>\geq 0.33\mu F</math>; 0805 = 10<math>\mu F</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td>0201 <math>\geq 0.01\mu F</math>; 0402 <math>\geq 0.033\mu F</math>; 0603 <math>\geq 0.15\mu F</math>; 0805 <math>\geq 0.68\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 4.7\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 0.22\mu F</math>; 0603 <math>&gt; 0.47\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 4.7\mu F</math>; 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3"><math>\leq 5\%</math></td> <td><math>\leq 12.5\%</math></td> <td>0402 = 1<math>\mu F</math>; 0805 = 10<math>\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0201 <math>\geq 0.012\mu F</math>; 0402 <math>\geq 0.22\mu F</math>; 0603 <math>\geq 0.33\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td><math>\leq 15\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 1\mu F</math></td> </tr> <tr> <td>6.3V</td> <td><math>\leq 10\%</math></td> <td><math>\leq 15\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 0.47\mu F</math>; 0603 <math>\geq 10\mu F</math>; 0805 <math>\geq 4.7\mu F</math>; 1206 <math>\geq 47\mu F</math>; 1210 <math>\geq 100\mu F</math></td> </tr> <tr> <td>4V</td> <td><math>\leq 15\%</math></td> <td><math>\leq 20\%</math></td> <td>0402 <math>\geq 2.2\mu F</math></td> </tr> <tr> <td colspan="3">---</td> <td>---</td> </tr> <tr> <th colspan="3">X7S:</th> </tr> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th colspan="2">Exception of D.F. <math>\leq</math></th> </tr> <tr> <td rowspan="3"><math>\geq 100V</math></td> <td rowspan="3"><math>\leq 2.5\%</math></td> <td><math>\leq 3\%</math></td> <td>1206 <math>\geq 0.47\mu F</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td>0603 <math>\geq 0.068\mu F</math>; 0805 <math>&gt; 0.1\mu F</math>; 1206 <math>\geq 1\mu F</math>; 1210 <math>\geq 2.2\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0805 <math>&gt; 0.22\mu F</math>; 1210 <math>\geq 3.3\mu F</math></td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3"><math>\leq 2.5\%</math></td> <td><math>\leq 3\%</math></td> <td>0201(50V); 0603 <math>\geq 0.047\mu F</math>; 0805 <math>\geq 0.18\mu F</math>; 1206 <math>\geq 0.47\mu F</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td>0201 <math>\geq 0.01\mu F</math>; 1210 <math>\geq 3.3\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0402 <math>\geq 0.012\mu F</math>; 0603 <math>&gt; 0.1\mu F</math>; 0805 <math>\geq 1\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td>35V</td> <td><math>\leq 3.5\%</math></td> <td><math>\leq 10\%</math></td> <td>0603 <math>\geq 1\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3"><math>\leq 3.5\%</math></td> <td><math>\leq 5\%</math></td> <td>0201 <math>\geq 0.01\mu F</math>; 0805 <math>\geq 1\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td><math>\leq 7\%</math></td> <td>0603 <math>\geq 0.33\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 0.10\mu F</math>; 0603 <math>\geq 0.47\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 4.7\mu F</math>; 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3"><math>\leq 3.5\%</math></td> <td><math>\leq 12.5\%</math></td> <td>0402 <math>\geq 0.33\mu F</math></td> </tr> <tr> <td><math>\leq 5\%</math></td> <td>0201 <math>\geq 0.01\mu F</math>; 0402 <math>\geq 0.033\mu F</math>; 0603 <math>\geq 0.15\mu F</math>; 0805 <math>\geq 0.68\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 4.7\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 0.22\mu F</math>; 0603 <math>&gt; 0.47\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 4.7\mu F</math>; 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3"><math>\leq 5\%</math></td> <td><math>\leq 12.5\%</math></td> <td>0402 = 1<math>\mu F</math>; 0805 = 10<math>\mu F</math></td> </tr> <tr> <td><math>\leq 10\%</math></td> <td>0201 <math>\geq 0.012\mu F</math>; 0402 <math>\geq 0.22\mu F</math>; 0603 <math>\geq 0.33\mu F</math>; 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td><math>\leq 15\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 1\mu F</math></td> </tr> <tr> <td>6.3V</td> <td><math>\leq 10\%</math></td> <td><math>\leq 15\%</math></td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 1\mu F</math>; 0603 <math>\geq 10\mu F</math>; 0805 <math>\geq 4.7\mu F</math>; 1206 <math>\geq 47\mu F</math>; 1210 <math>\geq 100\mu F</math></td> </tr> <tr> <td>4V</td> <td><math>\leq 15\%</math></td> <td><math>\leq 20\%</math></td> <td>0402 <math>\geq 2.2\mu F</math></td> </tr> <tr> <td colspan="3">---</td> <td>---</td> </tr> </tbody> </table> | X6S:         |                          |  | Rated vol. | D.F. $\leq$ | Exception of D.F. $\leq$ | $\geq 100V$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu F$ | $\leq 5\%$ | 0603 $\geq 0.068\mu F$ ; 0805 $> 0.1\mu F$ ; 1206 $\geq 1\mu F$ ; 1210 $\geq 2.2\mu F$ | $\leq 10\%$ | 0805 $> 0.22\mu F$ ; 1210 $\geq 3.3\mu F$ | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu F$ ; 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$ ; 1210 $\geq 3.3\mu F$ | $\leq 10\%$ | 0402 $\geq 0.012\mu F$ ; 0603 $> 0.1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$ | 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$ | 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$ | $\leq 7\%$ | 0603 $\geq 0.33\mu F$ | $\leq 10\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$ | 16V | $\leq 3.5\%$ | $\leq 12.5\%$ | 0402 $\geq 0.33\mu F$ ; 0805 = 10 $\mu F$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$ ; 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$ | $\leq 10\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $> 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$ | 10V | $\leq 5\%$ | $\leq 12.5\%$ | 0402 = 1 $\mu F$ ; 0805 = 10 $\mu F$ | $\leq 10\%$ | 0201 $\geq 0.012\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $\geq 0.33\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 22\mu F$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$ | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.47\mu F$ ; 0603 $\geq 10\mu F$ ; 0805 $\geq 4.7\mu F$ ; 1206 $\geq 47\mu F$ ; 1210 $\geq 100\mu F$ | 4V | $\leq 15\%$ | $\leq 20\%$ | 0402 $\geq 2.2\mu F$ | --- |  |  | --- | X7S: |  |  | Rated vol. | D.F. $\leq$ | Exception of D.F. $\leq$ |  | $\geq 100V$ | $\leq 2.5\%$ | $\leq 3\%$ | 1206 $\geq 0.47\mu F$ | $\leq 5\%$ | 0603 $\geq 0.068\mu F$ ; 0805 $> 0.1\mu F$ ; 1206 $\geq 1\mu F$ ; 1210 $\geq 2.2\mu F$ | $\leq 10\%$ | 0805 $> 0.22\mu F$ ; 1210 $\geq 3.3\mu F$ | 50V | $\leq 2.5\%$ | $\leq 3\%$ | 0201(50V); 0603 $\geq 0.047\mu F$ ; 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$ ; 1210 $\geq 3.3\mu F$ | $\leq 10\%$ | 0402 $\geq 0.012\mu F$ ; 0603 $> 0.1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$ | 35V | $\leq 3.5\%$ | $\leq 10\%$ | 0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$ | 25V | $\leq 3.5\%$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$ | $\leq 7\%$ | 0603 $\geq 0.33\mu F$ | $\leq 10\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$ | 16V | $\leq 3.5\%$ | $\leq 12.5\%$ | 0402 $\geq 0.33\mu F$ | $\leq 5\%$ | 0201 $\geq 0.01\mu F$ ; 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$ | $\leq 10\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $> 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$ | 10V | $\leq 5\%$ | $\leq 12.5\%$ | 0402 = 1 $\mu F$ ; 0805 = 10 $\mu F$ | $\leq 10\%$ | 0201 $\geq 0.012\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $\geq 0.33\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 22\mu F$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$ | 6.3V | $\leq 10\%$ | $\leq 15\%$ | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$ ; 0603 $\geq 10\mu F$ ; 0805 $\geq 4.7\mu F$ ; 1206 $\geq 47\mu F$ ; 1210 $\geq 100\mu F$ | 4V | $\leq 15\%$ | $\leq 20\%$ | 0402 $\geq 2.2\mu F$ | --- |  |  | --- |
|  |  |   | X6S:  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | Rated vol.  | D.F. $\leq$  | Exception of D.F. $\leq$ |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | $\geq 100V$   | $\leq 2.5\%$ | $\leq 3\%$               | 1206 $\geq 0.47\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 5\%$               | 0603 $\geq 0.068\mu F$ ; 0805 $> 0.1\mu F$ ; 1206 $\geq 1\mu F$ ; 1210 $\geq 2.2\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 10\%$              | 0805 $> 0.22\mu F$ ; 1210 $\geq 3.3\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 50V   | $\leq 2.5\%$ | $\leq 3\%$               | 0201(50V); 0603 $\geq 0.047\mu F$ ; 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 5\%$               | 0201 $\geq 0.01\mu F$ ; 1210 $\geq 3.3\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 10\%$              | 0402 $\geq 0.012\mu F$ ; 0603 $> 0.1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$                                 |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 35V   | $\leq 3.5\%$ | $\leq 10\%$              | 0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 25V   | $\leq 3.5\%$ | $\leq 5\%$               | 0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 7\%$               | 0603 $\geq 0.33\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 10\%$              | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$     |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 16V   | $\leq 3.5\%$ | $\leq 12.5\%$            | 0402 $\geq 0.33\mu F$ ; 0805 = 10 $\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 5\%$               | 0201 $\geq 0.01\mu F$ ; 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$ |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 10\%$              | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $> 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$        |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 10V   | $\leq 5\%$   | $\leq 12.5\%$            | 0402 = 1 $\mu F$ ; 0805 = 10 $\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 10\%$              | 0201 $\geq 0.012\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $\geq 0.33\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 22\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 15\%$              | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 6.3V  | $\leq 10\%$  | $\leq 15\%$              | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.47\mu F$ ; 0603 $\geq 10\mu F$ ; 0805 $\geq 4.7\mu F$ ; 1206 $\geq 47\mu F$ ; 1210 $\geq 100\mu F$       |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 4V  | $\leq 15\%$  | $\leq 20\%$              | 0402 $\geq 2.2\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | ---   |              |                          | ---  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | X7S:  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | Rated vol.  | D.F. $\leq$  | Exception of D.F. $\leq$ |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | $\geq 100V$   | $\leq 2.5\%$ | $\leq 3\%$               | 1206 $\geq 0.47\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 5\%$               | 0603 $\geq 0.068\mu F$ ; 0805 $> 0.1\mu F$ ; 1206 $\geq 1\mu F$ ; 1210 $\geq 2.2\mu F$   |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   |   |              | $\leq 10\%$              | 0805 $> 0.22\mu F$ ; 1210 $\geq 3.3\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  |   | 50V   | $\leq 2.5\%$ | $\leq 3\%$               | 0201(50V); 0603 $\geq 0.047\mu F$ ; 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| $\leq 5\%$   | 0201 $\geq 0.01\mu F$ ; 1210 $\geq 3.3\mu F$   |   |   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| $\leq 10\%$  | 0402 $\geq 0.012\mu F$ ; 0603 $> 0.1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$ |   |   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| 35V  | $\leq 3.5\%$   | $\leq 10\%$   | 0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| 25V  | $\leq 3.5\%$   | $\leq 5\%$  | 0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  | $\leq 7\%$  | 0603 $\geq 0.33\mu F$   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  | $\leq 10\%$   | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| 16V  | $\leq 3.5\%$   | $\leq 12.5\%$   | 0402 $\geq 0.33\mu F$   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  | $\leq 5\%$  | 0201 $\geq 0.01\mu F$ ; 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  | $\leq 10\%$   | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $> 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| 10V  | $\leq 5\%$   | $\leq 12.5\%$   | 0402 = 1 $\mu F$ ; 0805 = 10 $\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  | $\leq 10\%$   | 0201 $\geq 0.012\mu F$ ; 0402 $\geq 0.22\mu F$ ; 0603 $\geq 0.33\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 22\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
|  |  | $\leq 15\%$   | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| 6.3V   | $\leq 10\%$  | $\leq 15\%$   | 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$ ; 0603 $\geq 10\mu F$ ; 0805 $\geq 4.7\mu F$ ; 1206 $\geq 47\mu F$ ; 1210 $\geq 100\mu F$   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| 4V   | $\leq 15\%$  | $\leq 20\%$   | 0402 $\geq 2.2\mu F$  |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| ---  |  |   | ---   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |
| * No evidence of damage or flash over during test. |  |   |   |              |                          |  |            |             |                          |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |   |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |  |    |             |             |                      |     |  |  |     |      |  |  |            |             |                          |  |             |              |            |                       |            |  |             |   |     |              |            |   |            |  |             |  |     |              |             |  |     |              |            |  |            |                       |             |  |     |              |               |                       |            |  |             |   |     |            |               |                                      |             |  |             |   |      |             |             |   |    |             |             |                      |     |  |  |     |

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

Multilayer Ceramic Capacitors

| No   | Item   | Test Condition   | Requirements  |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
|--|--|--|---|----------------|-----------------------|--------------------|---|--|--|---|--|---|-------------------------|-------------|---------------|-----------------------|------------------------------|--------------------------------|--------------------|---|------------------|--|---|---|--|--|-------|------|--------------------|-----------------|--------------------|--------------------------|--|-------------------|--|--|------|------|---------------|---------------|--|---|---|-------------------|------------------|--|------|-----------|----------------|----------------|---|--------------------------|
| 5.   | Insulation Resistance  | *Test temp.: Room Temperature.<br>*To apply rated voltage for MAX. 120sec.   | 10GΩ or $RxC \geq 500\Omega \cdot F$ whichever is smaller.<br>Class II (X7R, X7E, X5R, X6S, X7S)  |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
|  |  |  | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R</td> <td rowspan="6">10GΩ or <math>RxC \geq 100 \Omega \cdot F</math> whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V ; 4V ; Size ≥ 1812</td> <td></td> </tr> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> <tr> <td>All X6S items, All X7S items</td> <td rowspan="8"><math>RxC \geq 50 \Omega \cdot F</math>.</td> </tr> <tr> <td>100V: 1210 ≥ 3.3μF</td> </tr> <tr> <td>50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF;</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF</td> </tr> <tr> <td>16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF</td> </tr> <tr> <td>10V: 0201 &gt; 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF</td> </tr> <tr> <td>6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 &gt; 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF</td> </tr> <tr> <td>4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF</td> </tr> </tbody> </table> | Rated voltage  | Insulation Resistance | 100V: All X7R      | 10GΩ or $RxC \geq 100 \Omega \cdot F$ whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V ; 4V ; Size ≥ 1812 |             | Rated voltage | Insulation Resistance | All X6S items, All X7S items | $RxC \geq 50 \Omega \cdot F$ . | 100V: 1210 ≥ 3.3μF | 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF | 35V: 0603 ≥ 1μF; | 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF | 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF | 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF | 6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF | 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Rated voltage  | Insulation Resistance  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 100V: All X7R  | 10GΩ or $RxC \geq 100 \Omega \cdot F$ whichever is smaller.                |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF  |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF                                      |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 6.3V ; 4V ; Size ≥ 1812  |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Rated voltage  | Insulation Resistance  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| All X6S items, All X7S items   | $RxC \geq 50 \Omega \cdot F$ .   |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 100V: 1210 ≥ 3.3μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF  |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 35V: 0603 ≥ 1μF;   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF  |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF  |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 6.   | Temperature Coefficient  | With no electrical load.   |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
|  |  | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X7S</td> <td>-55~125°C at 25°C</td> <td>X7S</td> <td>Within ±22%</td> </tr> <tr> <td>X5R</td> <td>-55~85°C at 25°C</td> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> <td>X6S</td> <td>Within ±22%</td> </tr> </tbody> </table> <p>* Before initial measurement (Class II only)<br/>To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br/>* Measurement voltage for Class II:</p> <table border="1"> <thead> <tr> <th>01005</th> <th>0201</th> </tr> </thead> <tbody> <tr> <td>Cap ≤ 0.01μF: 0.5V</td> <td>Cap &lt; 0.1μF: 1V</td> </tr> <tr> <td>Cap &gt; 0.01μF: 0.2V</td> <td>0.1μF ≤ Cap &lt; 1μF: 0.2V*</td> </tr> <tr> <td></td> <td>Cap ≥ 1μF: 0.1V**</td> </tr> <tr> <td>*0201X104/6.3V~25V: 0.5V<br/>0201X224/10V~25V: 0.5V<br/>0201X474/10V: 0.5V</td> <td>*0201S104/6.3V~16V: 0.3V<br/>0201S224/6.3V: 0.3V<br/>0201X105/6.3V&amp;10V: 0.3V</td> </tr> <tr> <th>0402</th> <th>0603</th> </tr> <tr> <td>Cap &lt; 1μF: 1V</td> <td>Cap &lt; 1μF: 1V</td> </tr> <tr> <td>Cap = 1μF: 0.5V**<br/>0402B224-16V: 0.5V<br/>0402B334/474-6.3V&amp;10V: 0.5V<br/>0402S334/474-6.3V: 0.5V<br/>0402X225/475-6.3V: 0.5V</td> <td>1μF ≤ Cap ≤ 4.7μF: 0.5V<br/>0603X106-10V: 0.5V</td> </tr> <tr> <td>1μF &lt; Cap &lt; 10μF: 0.2V<br/>**0402B105M6R3V: 0.2V</td> <td>Cap &gt; 4.7μF: 0.2V</td> </tr> <tr> <td>Cap ≥ 10μF: 0.1V</td> <td></td> </tr> <tr> <th>0805</th> <th>1206/1210</th> </tr> <tr> <td>Cap &lt; 10μF: 1V</td> <td>Cap ≤ 10μF: 1V</td> </tr> <tr> <td>Cap = 10μF: 0.5V<br/>0805B475/6.3V~25V: 0.5V</td> <td>10μF &lt; Cap ≤ 100μF: 0.5V</td> </tr> <tr> <td>Cap &gt; 10μF: 0.2V</td> <td>Cap &gt; 100μF: 0.2V<br/>1206X107-6.3V: 0.2V<br/>1210S107-6.3V: 0.2V</td> </tr> </tbody> </table> | T.C.  | Operating Temp | T.C.                  | Capacitance Change | NPO   | -55~125°C at 25°C  | NPO  | Within ±30ppm/°C  | X7R  | -55~125°C at 25°C   | X7R                     | Within ±15% | X7S           | -55~125°C at 25°C     | X7S                          | Within ±22%                    | X5R                | -55~85°C at 25°C  | X5R              | Within ±15%  | X6S   | -55~105°C at 25°C                                       | X6S  | Within ±22%                                | 01005 | 0201 | Cap ≤ 0.01μF: 0.5V | Cap < 0.1μF: 1V | Cap > 0.01μF: 0.2V | 0.1μF ≤ Cap < 1μF: 0.2V* |  | Cap ≥ 1μF: 0.1V** | *0201X104/6.3V~25V: 0.5V<br>0201X224/10V~25V: 0.5V<br>0201X474/10V: 0.5V | *0201S104/6.3V~16V: 0.3V<br>0201S224/6.3V: 0.3V<br>0201X105/6.3V&10V: 0.3V | 0402 | 0603 | Cap < 1μF: 1V | Cap < 1μF: 1V | Cap = 1μF: 0.5V**<br>0402B224-16V: 0.5V<br>0402B334/474-6.3V&10V: 0.5V<br>0402S334/474-6.3V: 0.5V<br>0402X225/475-6.3V: 0.5V | 1μF ≤ Cap ≤ 4.7μF: 0.5V<br>0603X106-10V: 0.5V | 1μF < Cap < 10μF: 0.2V<br>**0402B105M6R3V: 0.2V | Cap > 4.7μF: 0.2V | Cap ≥ 10μF: 0.1V |  | 0805 | 1206/1210 | Cap < 10μF: 1V | Cap ≤ 10μF: 1V | Cap = 10μF: 0.5V<br>0805B475/6.3V~25V: 0.5V | 10μF < Cap ≤ 100μF: 0.5V |
| T.C.   | Operating Temp   | T.C.   | Capacitance Change  |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| NPO  | -55~125°C at 25°C  | NPO  | Within ±30ppm/°C  |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| X7R  | -55~125°C at 25°C  | X7R  | Within ±15%   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| X7S  | -55~125°C at 25°C  | X7S  | Within ±22%   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| X5R  | -55~85°C at 25°C   | X5R  | Within ±15%   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| X6S  | -55~105°C at 25°C  | X6S  | Within ±22%   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 01005  | 0201   |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap ≤ 0.01μF: 0.5V   | Cap < 0.1μF: 1V  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap > 0.01μF: 0.2V   | 0.1μF ≤ Cap < 1μF: 0.2V*   |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
|  | Cap ≥ 1μF: 0.1V**  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| *0201X104/6.3V~25V: 0.5V<br>0201X224/10V~25V: 0.5V<br>0201X474/10V: 0.5V   | *0201S104/6.3V~16V: 0.3V<br>0201S224/6.3V: 0.3V<br>0201X105/6.3V&10V: 0.3V |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 0402   | 0603   |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap < 1μF: 1V  | Cap < 1μF: 1V  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap = 1μF: 0.5V**<br>0402B224-16V: 0.5V<br>0402B334/474-6.3V&10V: 0.5V<br>0402S334/474-6.3V: 0.5V<br>0402X225/475-6.3V: 0.5V | 1μF ≤ Cap ≤ 4.7μF: 0.5V<br>0603X106-10V: 0.5V                              |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 1μF < Cap < 10μF: 0.2V<br>**0402B105M6R3V: 0.2V  | Cap > 4.7μF: 0.2V  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap ≥ 10μF: 0.1V   |  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| 0805   | 1206/1210  |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap < 10μF: 1V   | Cap ≤ 10μF: 1V   |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap = 10μF: 0.5V<br>0805B475/6.3V~25V: 0.5V  | 10μF < Cap ≤ 100μF: 0.5V   |  |   |                |                       |                    |   |  |  |   |  |   |                         |             |               |                       |                              |                                |                    |   |                  |  |   |   |  |  |       |      |                    |                 |                    |                          |  |                   |  |  |      |      |               |               |  |   |   |                   |                  |  |      |           |                |                |   |                          |
| Cap > 10μF: 0.2V   | Cap > 100μF: 0.2V<br>1206X107-6.3V: 0.2V<br>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**

| No.  | Item                                    | Test Condition  | Requirements  |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
|------|---|---|---|------------|-------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|---|
| 7.   | <b>Adhesive Strength of Termination</b> | * 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.   | <b>Vibration Resistance</b>             | * 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.   | <b>Solderability</b>                    | * Solder temperature: 235±5°C<br>* Dipping time: 2±0.5 sec.   | * 95% min. coverage of all metalized area.  |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 10.  | <b>Bending Test</b>                     | * 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.  | <b>Resistance to Soldering Heat</b>     | * 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.  | <b>Temperature Cycle</b>                | * Conduct the five cycles according to the temperatures and time. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<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

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

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

Multilayer Ceramic Capacitors

| No   | Item  | Test Condition  | Requirements   |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|--|---|---|--|---|-----------------------|-------------|---------|---------|------|-----------|------|---------------------|------|----------|--------|----------|------|-----|----------|----------|---------|---------|-----|----------|---------|---------------------|---------|---------|----------|---------|------|--------|------|---------------------|----------|-----------------------|-----|---------|--------|---------------------|------|-----------------|------|---------|-----|---------|--------|---------|--------|---------------------|----------|---------|------|---------|----------------------|------|-------------|---------|-----------|---------|---|---------------|-----------------------|--------------------------|---|--|---|---|--|--|--|-------------|------|--------|---|------------|--------|---------------------|------|-----|-----------------|---|---|-----|-----|----------------------------|--|--|-----|-----|-----------------------------|---|---|-----|-----|---|------------------|--|-----|-----|------------------|--|--|-----|-------|--|---|--|------|------|--|-----|----|------|-----|
| 15.  | High Temperature Load (Endurance)   | *Test temp. :<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%<br>Q/D.F. value:<br>NP0: More than 30pF, Q≥350<br>10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF, Q≥200+10C<br>X7R, X5R, X6S, X7S: |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
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|  |   | 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               |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | X7R/X7S   | 6.3V,10V   | C≥1.0μF   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   | 4V   | C≥22μF  |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 0603  | X5R/X7R/<br>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                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   | X6S  | 6.3V  | C≥22μF                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   |  | 10V,50V   | C≥10μF                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | X7R/X7S   | 16V,25V  | C≥10μF  |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   | X5R  | 16V,25V   | C≥22μF                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 1206  | X5R/X7R/X6S  | ≤6.3V   | C≥47μF                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 1210  | X5R/X7R/X6S  | 16V   | C≥47μF                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   |  | X7R   | 100V                  | C≥3.3μF     |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | TT15  | X5R  | 6.3V  | C>1.0μF               |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | TT21  | X5R/X7R/X6S  | ≤10V  | C≥10μF                |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | Rated vol.  | D.F. ≤   | Exception of D.F. ≤                               |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 100V  | ≤3%  | ≤6% 1206≥0.47μF                                   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   |  | ≤7% 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 |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 50V   | ≤3%  | ≤6% 0805>0.22μF;1210≥3.3μF                        |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| ≤7% 0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| ≤10% 1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 35V  | ≤5%   | ≤20% 0201≥0.01μF;1210≥3.3μF   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ≤20% 0402≥0.012μF;0603>0.1μF;0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF;   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ≤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;TTseries 0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;  |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 16V  | ≤5%   | ≤20% 0402≥0.33μF  |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ≤10% 0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF  |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ≤15% 0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF  |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 10V  | ≤7.5%   | ≤15% 0201≥0.012μF;0402≥0.22μF (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   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ≤30% 0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF  |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 6.3V   | ≤15%  | ≤30% 0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF  |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ---   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 4V   | ≤20%  | ---   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| **1VV items must follow de-rating conditions.<br>#1. 0603X106(10V)&0603S106(4V&6.3V):150% of rated voltage<br>(2) 150% of rated voltage for below range.   | *I.R.: ≥10V, 1GΩ or 50 Ω·F whichever is smaller.<br>Class II (X7R, X5R, X6S, X7S) |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X6S</td> <td>16V,25V</td> <td>C=0.1μF</td> </tr> <tr> <td>X7R</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="3">0603</td> <td rowspan="3">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>25V</td> <td>C=1.0μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/<br/>X6S/X7S</td> <td>50V</td> <td>C≥1.0μF</td> </tr> <tr> <td>10V,16V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="4">1206</td> <td rowspan="4">X7R</td> <td>100V</td> <td>C≥0.47μF</td> </tr> <tr> <td>50V</td> <td>C≥0.68μF</td> </tr> <tr> <td>35V</td> <td>C≥2.2μF</td> </tr> <tr> <td>10~25V</td> <td>C≥4.7μF/1</td> </tr> <tr> <td rowspan="3">1210</td> <td rowspan="3">X5R/X6S/<br/>X7S</td> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>50V</td> <td>C≥2.2μF</td> </tr> <tr> <td>100V</td> <td>C&gt;1.0μF</td> </tr> <tr> <td rowspan="2">1812</td> <td rowspan="2">X5R/X7R/<br/>X6S/X7S</td> <td>50V~100V</td> <td>C≥2.2μF</td> </tr> <tr> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td rowspan="2">1825<br/>2220<br/>2225</td> <td rowspan="2">X7R</td> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>100V~250V</td> <td>C≥1.0μF</td> </tr> </tbody> </table> | Size  | Dielectric  | Rated voltage  | Capacitance                                       | 0201                  | X5R/X6S     | 16V,25V | C=0.1μF | X7R  | 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 | 25V | C=1.0μF  | 0805    | X5R/X7R/<br>X6S/X7S | 50V     | C≥1.0μF | 10V,16V  | C≥1.0μF | 1206 | X7R    | 100V | C≥0.47μF            | 50V      | C≥0.68μF              | 35V | C≥2.2μF | 10~25V | C≥4.7μF/1           | 1210 | X5R/X6S/<br>X7S | 100V | C≥1.0μF | 50V | C≥2.2μF | 100V   | C>1.0μF | 1812   | X5R/X7R/<br>X6S/X7S | 50V~100V | C≥2.2μF | ≤50V | C≥4.7μF | 1825<br>2220<br>2225 | X7R  | 100V        | C≥1.0μF | 100V~250V | C≥1.0μF | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R;1210≥3.3μF</td> <td rowspan="10">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> <tr> <td></td> </tr> <tr> <td></td> </tr> <tr> <td></td> </tr> </tbody> </table> | Rated voltage | Insulation Resistance | 100V: All X7R;1210≥3.3μF | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller. | 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF | 35V:0603≥1μF;0805≥2.2μF; 1206 ≥ 2.2μF;1210 ≥ 10μF | 25V:0201 ≥ 0.1μF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF | 16V: 0201 ≥ 0.1μF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF | 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF | 6.3V ; 4V ; All X6S/X7S items; Size≥1812 |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| Size   | Dielectric  | Rated voltage   | Capacitance  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 0201   | X5R/X6S   | 16V,25V   | C=0.1μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | X7R   | 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  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 25V   | C=1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 0805   | X5R/X7R/<br>X6S/X7S   | 50V   | C≥1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 10V,16V   | C≥1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 1206   | X7R   | 100V  | C≥0.47μF   |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 50V   | C≥0.68μF   |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 35V   | C≥2.2μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 10~25V  | C≥4.7μF/1  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 1210   | X5R/X6S/<br>X7S   | 100V  | C≥1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 50V   | C≥2.2μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 100V  | C>1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 1812   | X5R/X7R/<br>X6S/X7S   | 50V~100V  | C≥2.2μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | ≤50V  | C≥4.7μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 1825<br>2220<br>2225   | X7R   | 100V  | C≥1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   | 100V~250V   | C≥1.0μF  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| Rated voltage  | Insulation Resistance   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 100V: All X7R;1210≥3.3μF   | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller.   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 35V:0603≥1μF;0805≥2.2μF; 1206 ≥ 2.2μF;1210 ≥ 10μF  |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 25V:0201 ≥ 0.1μF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF  |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 16V: 0201 ≥ 0.1μF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| 6.3V ; 4V ; All X6S/X7S items; Size≥1812   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
|  |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |
| (3) ≤ 6.3V or C ≥10μF :150% of rated voltage.<br>(4) 10V ≤ Ur < 250V: 200% of rated voltage.<br>(5) 500V: 150% of rated voltage.<br>(6) Ur ≥ 630V: 120% of rated voltage   | ** De-rating conditions:<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.   |   |   |  |   |                       |             |         |         |      |           |      |                     |      |          |        |          |      |     |          |          |         |         |     |          |         |                     |         |         |          |         |      |        |      |                     |          |                       |     |         |        |                     |      |                 |      |         |     |         |        |         |        |                     |          |         |      |         |                      |      |             |         |           |         |   |               |                       |                          |   |  |   |   |  |  |  |             |      |        |   |            |        |                     |      |     |                 |   |   |     |     |                            |  |  |     |     |                             |   |   |     |     |   |                  |  |     |     |                  |  |  |     |       |  |   |  |      |      |  |     |    |      |     |

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

Multilayer Ceramic Capacitors

APPENDIXES

■ Tape & reel dimensions



Fig. 2 The dimension of paper tape



Fig. 3 The dimension of plastic tape

| Size              | 0201              | 0402              | 0603              | 0805              |                   |                 | 1206              |                   |                   | 1210              |                   |                   |                   | 1808              |                   | 1812              |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Thickness         | L                 | N,E               | S,H,X             | A,H               | B,T               | D,I             | B,T               | C,J,D             | G,P               | T                 | C,D               | G,K               | M                 | D,F               | G,K               | D,F               | G,K               | M,U               |
| 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>    | -                 | -                 | -                 | -                 | -                 | < 2.00          | -                 | < 2.00            | < 2.50            | < 1.50            | < 2.00            | < 2.50            | < 3.20            | < 2.00            | < 2.50            | < 2.00            | < 2.50            | < 3.50            |
| W                 | 8.00<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            | 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            | 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           | 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   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00            | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 4.00<br>+/-0.10   | 8.00<br>+/-0.10   | 8.00<br>+/-0.10   | 8.00<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            | 2.00<br>+/-0.05   | 2.00<br>+/-0.05   | 2.00<br>+/-0.05   | 2.00<br>+/-0.05   | 2.00<br>+/-0.05   | 2.00<br>+/-0.05   | 2.00<br>+/-0.05   | 2.00<br>+/-0.10   | 2.00<br>+/-0.10   | 2.00<br>+/-0.10   | 2.00<br>+/-0.10   | 2.00<br>+/-0.10   |
| 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            | 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   | 1.50<br>+/-0.10   | 1.50<br>+/-0.10   | 1.50<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            | 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            | 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>+/-0.10   | 3.50<br>+/-0.10   | 3.50<br>+/-0.10   | 3.50<br>+/-0.10   | 3.50<br>+/-0.10   |



Fig. 4 The dimension of reel

| Size           | 0201, 0402, 0603, 0805, 1206, 1210 |           |           | 1812        |
|----------------|------------------------------------|-----------|-----------|-------------|
| Reel size      | 7"                                 | 10"       | 13"       | 7"          |
| C              | 13.0±0.5                           | 13.0±0.5  | 13.0±0.5  | 13.0±0.5    |
| 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



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

\*Customized label is available upon request

Constructions

| No. | Name             | NPO                      | X7R, X5R, X6S, X7S       |
|-----|------------------|--------------------------|--------------------------|
| ①   | Ceramic material | CaZrO <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                       |



Fig. 5 The construction of MLCC

Storage and handling conditions

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

Cautions:

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

**Multilayer Ceramic Capacitors**

**Recommended soldering conditions**

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



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



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



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