

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MT)

Qualified to AEC-Q200

0201 to 1210 Sizes (10V to 1000V)

NP0, X7R 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 MT series MLCC is made by NP0,X7R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MT series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications.

**2. FEATURES**

- a. A wide selection of sizes is available (0201 to 0805).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).
- d. The MT series meet AEC-Q200 requirement.

**3. APPLICATIONS**

- a. For Navigation & Information equipments.
- b. For entertainment equipments
- c. For comfortable equipments.
- d. For Automotive electronic equipment.

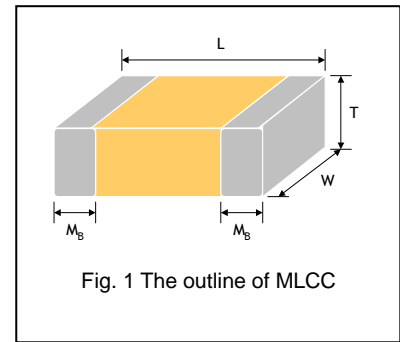
**4. HOW TO ORDER**

| <u>MT</u>   | <u>18</u>  | <u>N</u>             | <u>102</u>   | <u>J</u>  | <u>500</u>  | <u>C</u>           | <u>I</u>                    |
|---|--|----------------------|--|---|---|--------------------|-----------------------------|
| <u>Series</u>   | <u>Size</u>  | <u>Dielectric</u>    | <u>Capacitance</u>   | <u>Tolerance</u>  | <u>Rated voltage</u>  | <u>Termination</u> | <u>Packaging style</u>      |
| MT= Automotive safe concern (with AEC-Q200 qualification) | 03=0201 (0603)<br>15=0402 (1005)<br>18=0603 (1608)<br>21=0805 (2012)<br>31=1206 (3216)<br>32=1210 (3225) | N=NP0 (COG)<br>B=X7R | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>102=10x10 <sup>2</sup> =1000pF | A=±0.05pF<br>B=±0.1pF<br>C=±0.25pF<br>D=±0.5pF<br>F=±1%<br>G=±2%<br>J=±5%<br>K=±10%<br>M=±20% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>100=10 VDC<br>160=16 VDC<br>250=25 VDC<br>500=50 VDC<br>101=100 VDC<br>201=200 VDC<br>251=250 VDC<br>501=500 VDC<br>631=630 VDC<br>102=1000 VDC | C=Cu/Ni/Sn         | T=7" reeled<br>G=13" reeled |

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**5. EXTERNAL DIMENSIONS**

| Size<br>Inch (mm) | L (mm)              | W (mm)              | T (mm)/Symbol       | Remark | M <sub>B</sub> (mm) |
|-------------------|---------------------|---------------------|---------------------|--------|---------------------|
| 0201 (0603)       | 0.60±0.03           | 0.30±0.03           | 0.30±0.03           | L #    | 0.15±0.05           |
| 0402 (1005)       | 1.00±0.05           | 0.50±0.05           | 0.50±0.05           | N #    | 0.25<br>+0.05/-0.10 |
| 0603 (1608)       | 1.60±0.10           | 0.80±0.10           | 0.80±0.07           | S      | 0.40±0.15           |
|                   | 1.60<br>+0.15/-0.10 | 0.80<br>+0.15/-0.10 | 0.80<br>+0.15/-0.10 | X      |                     |
| 0805 (2012)       | 2.00±0.15           | 1.25±0.10           | 0.60±0.10           | A      | 0.50±0.20           |
|                   |                     |                     | 0.80±0.10           | B      |                     |
|                   | 1.25±0.10           | D #                 |                     |        |                     |
|                   | 1.25±0.20           | I #                 |                     |        |                     |
| 1206 (3216)       | 3.20±0.15           | 1.60±0.15           | 0.80±0.10           | B      | 0.60±0.20           |
|                   |                     |                     | 0.95±0.10           | C      |                     |
|                   |                     |                     | 1.25±0.10           | D #    |                     |
|                   | 3.20±0.20           | 1.60±0.20           | 1.15±0.15           | J #    |                     |
|                   | 1.60±0.20           |                     | G #                 |        |                     |
|                   | 3.20+0.3/-0.1       |                     | 1.60+0.30/-0.10     | P #    |                     |
| 1210 (3225)       | 3.20±0.30           | 2.50±0.20           | 0.95±0.10           | C #    | 0.75±0.25           |
|                   |                     |                     | 1.25±0.10           | D #    |                     |
|                   | 3.20±0.40           | 2.50±0.30           | 1.60±0.20           | G #    |                     |
|                   |                     |                     | 2.00±0.20           | K #    |                     |
|                   |                     |                     | 2.50±0.30           | M #    |                     |



# Reflow soldering only is recommended.

**6. GENERAL ELECTRICAL DATA**

|                                   |  |                             |
|-----------------------------------|--|-----------------------------|
| <b>Dielectric</b>                 | NPO  | X7R                         |
| <b>Size</b>                       | 0201, 0402, 0603, 0805, 1206, 1210   | 0402, 0603, 0805, 1206      |
| <b>Capacitance range*</b>         | 0.1pF to 0.047uF   | 100pF to 2.2uF              |
| <b>Capacitance tolerance**</b>    | Cap≤5pF <sup>#1</sup> : A (±0.05pF), B (±0.1pF), C (±0.25pF)<br>5pF<Cap<10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF)<br>Cap≥10pF: F (±1%), G (±2%), J (±5%) | J (±5%), K (±10%), M (±20%) |
| <b>Rated voltage (WVDC)</b>       | 10V, 16V, 25V, 50V, 100V, 200V, 250, 500, 630, 1000  |                             |
| <b>Operating temperature</b>      | -55 to +125°C  |                             |
| <b>Capacitance characteristic</b> | ±30ppm/°C  | ±15%                        |
| <b>Termination</b>                | Ni/Sn (lead-free termination)  |                             |

#1: NPO, 0.1pF product only provide B tolerance.

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

NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature  
Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature for X7R.

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

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**7. CAPACITANCE RANGE**

**NP0 Dielectric**

| DIELECTRIC    |             | NP0  |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |
|---------------|-------------|------|----|----|----|-----|------|----|----|----|-----|------|----|----|----|-----|-----|-----|
| SIZE          |             | 0201 |    |    |    |     | 0402 |    |    |    |     | 0603 |    |    |    |     |     |     |
| RATED VOLTAGE |             | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance   | 0.1pF (0R1) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   |      |    |    |    |     |     |     |
|               | 0.2pF (0R2) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   |      |    |    |    |     |     |     |
|               | 0.3pF (0R3) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   |      |    |    |    |     |     |     |
|               | 0.4pF (0R4) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   |      |    |    |    |     |     |     |
|               | 0.5pF (0R5) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 0.6pF (0R6) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 0.7pF (0R7) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 0.8pF (0R8) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 0.9pF (0R9) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 1.0pF (1R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 1.2pF (1R2) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 1.5pF (1R5) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 1.8pF (1R8) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 2.0pF (2R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 2.2pF (2R2) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 2.7pF (2R7) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 3.0pF (3R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 3.3pF (3R3) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 3.9pF (3R9) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 4.0pF (4R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 4.7pF (4R7) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 5.0pF (5R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 5.6pF (5R6) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 6.0pF (6R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 6.8pF (6R8) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 7.0pF (7R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 8.0pF (8R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 8.2pF (8R2) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 9.0pF (9R0) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 10pF (100)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 12pF (120)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 15pF (150)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 18pF (180)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 22pF (220)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 27pF (270)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 33pF (330)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 39pF (390)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 47pF (470)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 56pF (560)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 68pF (680)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 82pF (820)  | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 100pF (101) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 120pF (121) | L    | L  | L  | L  | L   | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 150pF (151) |      |    |    |    |     | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
|               | 180pF (181) |      |    |    |    |     | N    | N  | N  | N  | N   | S    | S  | S  | S  | S   | S   | S   |
| 220pF (221)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | S   | S   |     |
| 270pF (271)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | X   | X   |     |
| 330pF (331)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | X   | X   |     |
| 390pF (391)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | X   | X   |     |
| 470pF (471)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  | X   | X   |     |
| 560pF (561)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  |     |     |     |
| 680pF (681)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  |     |     |     |
| 820pF (821)   |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  |     |     |     |
| 1,000pF (102) |             |      |    |    |    | N   | N    | N  | N  | N  | S   | S    | S  | S  | S  |     |     |     |
| 1,200pF (122) |             |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 1,500pF (152) |             |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 1,800pF (182) |             |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 2,200pF (222) |             |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 2,700pF (272) |             |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 3,300pF (332) |             |      |    |    |    |     |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 3,900pF (392) |             |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |
| 4,700pF (472) |             |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |
| 5,600pF (562) |             |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |
| 6,800pF (682) |             |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |
| 8,200pF (822) |             |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |
| 0.01μF (103)  |             |      |    |    |    |     |      |    |    |    |     |      |    |    |    |     |     |     |

\* NP0, 0.1pF product only provide B tolerance.

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

Multilayer Ceramic Capacitors

**NP0 Dielectric**

| DIELECTRIC    |             | NP0  |    |    |    |     |     |     |     |     |
|---------------|-------------|------|----|----|----|-----|-----|-----|-----|-----|
| SIZE          |             | 0805 |    |    |    |     |     |     |     |     |
| RATED VOLTAGE |             | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 |
| Capacitance   | 0.5pF (0R5) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 0.6pF (0R6) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 0.7pF (0R7) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 0.8pF (0R8) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 0.9pF (0R9) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 1.0pF (1R0) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 1.2pF (1R2) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 1.5pF (1R5) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 1.8pF (1R8) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 2.2pF (2R2) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 2.7pF (2R7) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 3.3pF (3R3) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 3.9pF (3R9) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 4.7pF (4R7) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 5.6pF (5R6) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 6.8pF (6R8) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 8.2pF (8R2) | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 10pF (100)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 12pF (120)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 15pF (150)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 18pF (180)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 22pF (220)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 27pF (270)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 33pF (330)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 39pF (390)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 47pF (470)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 56pF (560)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 68pF (680)  | A    | A  | A  | A  | A   | A   | A   | A   | A   |
|               | 82pF (820)  | A    | A  | A  | A  | A   | A   | A   | B   | B   |
|               | 100pF (101) | A    | A  | A  | A  | A   | B   | B   | B   | B   |
|               | 120pF (121) | A    | A  | A  | A  | A   | B   | B   | D   | D   |
|               | 150pF (151) | A    | A  | A  | A  | A   | D   | D   | D   | D   |
|               | 180pF (181) | A    | A  | A  | A  | A   | D   | D   | D   | D   |
|               | 220pF (221) | A    | A  | A  | A  | A   | D   | D   | D   | D   |
|               | 270pF (271) | A    | A  | A  | A  | A   | D   | D   | D   | D   |
|               | 330pF (331) | A    | A  | A  | A  | A   | D   | D   | D   | D   |
|               | 390pF (391) | B    | B  | B  | B  | B   | D   | D   | D   | D   |
|               | 470pF (471) | B    | B  | B  | B  | B   | D   | D   | I   | I   |
|               | 560pF (561) | B    | B  | B  | B  | B   | D   | D   | I   | I   |
|               | 680pF (681) | B    | B  | B  | B  | B   | D   | D   | I   | I   |
| 820pF (821)   | B           | B    | B  | B  | B  | D   | D   | I   | I   |     |
| 1,000pF (102) | B           | B    | B  | B  | B  | D   | D   | I   | I   |     |
| 1,200pF (122) | B           | B    | B  | B  | B  | D   | D   |     |     |     |
| 1,500pF (152) | B           | B    | B  | B  | B  | D   | D   |     |     |     |
| 1,800pF (182) | B           | B    | B  | B  | B  | D   | D   |     |     |     |
| 2,200pF (222) | B           | B    | B  | B  | B  | D   | D   |     |     |     |
| 2,700pF (272) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 3,300pF (332) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 3,900pF (392) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 4,700pF (472) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 5,600pF (562) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 6,800pF (682) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 8,200pF (822) | D           | D    | D  | D  | D  |     |     |     |     |     |
| 0.01μF (103)  | D           | D    | D  | D  | D  |     |     |     |     |     |

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

Multilayer Ceramic Capacitors

**NP0 Dielectric**

| DIELECTRIC    |             | NP0  |    |    |    |     |     |     |     |     |      |
|---------------|-------------|------|----|----|----|-----|-----|-----|-----|-----|------|
| SIZE          |             | 1206 |    |    |    |     |     |     |     |     |      |
| RATED VOLTAGE |             | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance   | 1.0pF (1R0) |      |    |    |    |     |     |     |     |     |      |
|               | 1.2pF (1R2) | B    | B  | B  | B  | B   | B   | B   | B   | B   |      |
|               | 1.5pF (1R5) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 1.8pF (1R8) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 2.2pF (2R2) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 2.7pF (2R7) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 3.3pF (3R3) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 3.9pF (3R9) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 4.7pF (4R7) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 5.6pF (5R6) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 6.8pF (6R8) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 8.2pF (8R2) | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 10pF (100)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 12pF (120)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 15pF (150)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 18pF (180)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    |
|               | 22pF (220)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 27pF (270)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 33pF (330)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 39pF (390)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 47pF (470)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 56pF (560)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 68pF (680)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 82pF (820)  | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 100pF (101) | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 120pF (121) | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 150pF (151) | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    |
|               | 180pF (181) | B    | B  | B  | B  | B   | B   | B   | B   | B   | G    |
|               | 220pF (221) | B    | B  | B  | B  | B   | B   | B   | B   | B   | G    |
|               | 270pF (271) | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    |
|               | 330pF (331) | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    |
|               | 390pF (391) | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    |
|               | 470pF (471) | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    |
|               | 560pF (561) | B    | B  | B  | B  | B   | B   | C   | D   | D   | G    |
|               | 680pF (681) | B    | B  | B  | B  | B   | B   | C   | D   | D   | G    |
| 820pF (821)   | B           | B    | B  | B  | B  | B   | C   | G   | G   | G   |      |
| 1,000pF (102) | B           | B    | B  | B  | B  | B   | C   | G   | G   | G   |      |
| 1,200pF (122) | B           | B    | B  | B  | B  | B   | C   | G   | G   | G   |      |
| 1,500pF (152) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 1,800pF (182) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 2,200pF (222) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 2,700pF (272) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 3,300pF (332) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 3,900pF (392) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 4,700pF (472) | B           | B    | B  | B  | B  | B   | D   | G   | G   | G   |      |
| 5,600pF (562) | B           | B    | B  | B  | B  | B   |     |     |     |     |      |
| 6,800pF (682) | C           | C    | C  | C  | C  | C   |     |     |     |     |      |
| 8,200pF (822) | D           | D    | D  | D  | D  | D   |     |     |     |     |      |
| 0.01μF (103)  | D           | D    | D  | D  | D  | D   |     |     |     |     |      |

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

Multilayer Ceramic Capacitors

**NP0 Dielectric**

| DIELECTRIC    |               | NP0  |    |    |    |     |     |     |     |     |      |
|---------------|---------------|------|----|----|----|-----|-----|-----|-----|-----|------|
| SIZE          |               | 1210 |    |    |    |     |     |     |     |     |      |
| RATED VOLTAGE |               | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance   | 10pF (100)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 12pF (120)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 15pF (150)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 18pF (180)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 22pF (220)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 27pF (270)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 33pF (330)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 39pF (390)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 47pF (470)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 56pF (560)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 68pF (680)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 82pF (820)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    |
|               | 100pF (101)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    |
|               | 120pF (121)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    |
|               | 150pF (151)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    |
|               | 180pF (181)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    |
|               | 220pF (221)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 270pF (271)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 330pF (331)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 390pF (391)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 470pF (471)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 560pF (561)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 680pF (681)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 820pF (821)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |
|               | 1,000pF (102) | C    | C  | C  | C  | C   | C   | D   | D   | D   | G    |
|               | 1,200pF (122) | C    | C  | C  | C  | C   | C   | D   | D   | D   |      |
|               | 1,500pF (152) | C    | C  | C  | C  | C   | D   | D   | D   | D   |      |
|               | 1,800pF (182) | C    | C  | C  | C  | C   | D   | D   | D   | D   |      |
|               | 2,200pF (222) | C    | C  | C  | C  | C   | D   | D   | D   | D   |      |
|               | 2,700pF (272) | C    | C  | C  | C  | C   | D   | D   | D   | D   |      |
|               | 3,300pF (332) | C    | C  | C  | C  | C   | D   | D   | D   | D   |      |
|               | 3,900pF (392) | C    | C  | C  | C  | C   | D   | D   | D   | D   |      |
|               | 4,700pF (472) | C    | C  | C  | C  | C   | G   | G   |     |     |      |
|               | 5,600pF (562) | C    | C  | C  | C  | C   | G   | G   |     |     |      |
|               | 6,800pF (682) | C    | C  | C  | C  | C   | G   | G   |     |     |      |
|               | 8,200pF (822) | C    | C  | C  | C  | C   | G   | G   |     |     |      |
|               | 0.010μF (103) | C    | C  | C  | C  | C   | G   | G   |     |     |      |
|               | 0.012μF (123) | D    | D  | D  | D  | D   |     |     |     |     |      |
|               | 0.015μF (153) | D    | D  | D  | D  | D   |     |     |     |     |      |
|               | 0.018μF (183) | K    | K  | K  | K  | K   |     |     |     |     |      |
| 0.022μF (223) | K             | K    | K  | K  | K  |     |     |     |     |     |      |
| 0.027μF (273) | K             | K    | K  | K  | K  |     |     |     |     |     |      |
| 0.033μF (333) | K             | K    | K  | K  | K  |     |     |     |     |     |      |
| 0.039μF (393) | K             | K    | K  | K  | K  |     |     |     |     |     |      |
| 0.047μF (473) | K             | K    | K  | K  | K  |     |     |     |     |     |      |

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Multilayer Ceramic Capacitors

**X7R Dielectric**

| DIELECTRIC    |               | X7R  |    |    |    |      |    |    |    |      |    |    |    |     |
|---------------|---------------|------|----|----|----|------|----|----|----|------|----|----|----|-----|
| SIZE          |               | 0201 |    |    |    | 0402 |    |    |    | 0603 |    |    |    |     |
| RATED VOLTAGE |               | 10   | 16 | 25 | 50 | 10   | 16 | 25 | 50 | 10   | 16 | 25 | 50 | 100 |
| Capacitance   | 100pF (101)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 120pF (121)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 150pF (151)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 180pF (181)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 220pF (221)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 270pF (271)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 330pF (331)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 390pF (391)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 470pF (471)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 560pF (561)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 680pF (681)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 820pF (821)   | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 1,000pF (102) | L    | L  | L  | L  | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 1,200pF (122) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 1,500pF (152) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 1,800pF (182) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 2,200pF (222) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 2,700pF (272) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 3,300pF (332) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 3,900pF (392) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 4,700pF (472) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 5,600pF (562) | L    | L  | L  |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 6,800pF (682) | L    |    |    |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 8,200pF (822) | L    |    |    |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 0.010μF (103) | L    |    |    |    | N    | N  | N  | N  | S    | S  | S  | S  | S   |
|               | 0.012μF (123) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | S  | X   |
|               | 0.015μF (153) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | S  | X   |
|               | 0.018μF (183) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | S  | X   |
|               | 0.022μF (223) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | S  | X   |
|               | 0.027μF (273) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | S  | X   |
|               | 0.033μF (333) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | X  | X   |
|               | 0.039μF (393) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | X  | X   |
|               | 0.047μF (473) |      |    |    |    | N    | N  | N  |    | S    | S  | S  | X  | X   |
| 0.056μF (563) |               |      |    |    | N  | N    | N  |    | S  | S    | S  | X  |    |     |
| 0.068μF (683) |               |      |    |    | N  | N    | N  |    | S  | S    | S  | X  |    |     |
| 0.082μF (823) |               |      |    |    | N  | N    | N  |    | S  | S    | S  | X  |    |     |
| 0.10μF (104)  |               |      |    |    | N  | N    | N  |    | S  | S    | S  | X  |    |     |
| 0.12μF (124)  |               |      |    |    |    |      |    |    | X  | X    | X  |    |    |     |
| 0.15μF (154)  |               |      |    |    |    |      |    |    | X  | X    | X  | X  |    |     |
| 0.18μF (184)  |               |      |    |    |    |      |    |    | X  | X    | X  |    |    |     |
| 0.22μF (224)  |               |      |    |    |    |      |    |    | X  | X    | X  | X  |    |     |
| 0.33μF (334)  |               |      |    |    |    |      |    |    | X  | X    | X  | X  |    |     |

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**X7R Dielectric**

| DIELECTRIC          |               | X7R  |    |    |    |     |     |     |     |      |    |    |    |    |     |     |     |     |     |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|------|----|----|----|----|-----|-----|-----|-----|-----|
| SIZE                |               | 0805 |    |    |    |     |     |     |     | 1206 |    |    |    |    |     |     |     |     |     |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630  | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 |
| Capacitance         | 100pF (101)   | B    | B  | B  | B  | B   | B   | B   | B   | B    |    |    |    |    |     | D   | D   | D   | D   |
|                     | 120pF (121)   | B    | B  | B  | B  | B   | B   | B   | B   | B    |    |    |    |    |     | D   | D   | D   | D   |
|                     | 150pF (151)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 180pF (181)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 220pF (221)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 270pF (271)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 330pF (331)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 390pF (391)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 470pF (471)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 560pF (561)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 680pF (681)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 820pF (821)   | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 1,000pF (102) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 1,200pF (122) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 1,500pF (152) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 1,800pF (182) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 2,200pF (222) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 2,700pF (272) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 3,300pF (332) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 3,900pF (392) | B    | B  | B  | B  | B   | B   | B   | B   | B    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 4,700pF (472) | B    | B  | B  | B  | B   | B   | B   | D   | D    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 5,600pF (562) | B    | B  | B  | B  | B   | B   | B   | D   | D    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 6,800pF (682) | B    | B  | B  | B  | B   | B   | B   | D   | D    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 8,200pF (822) | B    | B  | B  | B  | B   | B   | B   | D   | D    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 0.010μF (103) | B    | B  | B  | B  | B   | D   | D   | D   | D    | B  | B  | B  | B  | B   | D   | D   | D   | D   |
|                     | 0.012μF (123) | B    | B  | B  | B  | B   | D   | D   |     |      | B  | B  | B  | B  | B   | D   | D   |     |     |
|                     | 0.015μF (153) | B    | B  | B  | B  | B   | D   | D   |     |      | B  | B  | B  | B  | B   | D   | D   |     |     |
|                     | 0.018μF (183) | B    | B  | B  | B  | B   | D   | D   |     |      | B  | B  | B  | B  | B   | D   | D   |     |     |
|                     | 0.022μF (223) | B    | B  | B  | B  | B   | D   | D   |     |      | B  | B  | B  | B  | B   | D   | D   |     |     |
|                     | 0.027μF (273) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | B   |     |     |     |     |
|                     | 0.033μF (333) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | B   |     |     |     |     |
|                     | 0.039μF (393) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | B   |     |     |     |     |
|                     | 0.047μF (473) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | B   |     |     |     |     |
|                     | 0.056μF (563) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | B   |     |     |     |     |
|                     | 0.068μF (683) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | B   |     |     |     |     |
|                     | 0.082μF (823) | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | D   |     |     |     |     |
|                     | 0.10μF (104)  | B    | B  | B  | B  | D   |     |     |     |      | B  | B  | B  | B  | D   |     |     |     |     |
|                     | 0.12μF (124)  | B    | B  | B  | D  |     |     |     |     |      | B  | B  | B  | B  | D   |     |     |     |     |
|                     | 0.15μF (154)  | D    | D  | D  | D  |     |     |     |     |      | C  | C  | C  | C  | G   |     |     |     |     |
|                     | 0.18μF (184)  | D    | D  | D  | D  |     |     |     |     |      | C  | C  | C  | C  | G   |     |     |     |     |
| 0.22μF (224)        | D             | D    | D  | D  |    |     |     |     |     | C    | C  | C  | C  | G  |     |     |     |     |     |
| 0.27μF (274)        | D             | D    | D  | I  |    |     |     |     |     | C    | C  | C  | D  |    |     |     |     |     |     |
| 0.33μF (334)        | D             | D    | D  | I  |    |     |     |     |     | C    | C  | C  | D  |    |     |     |     |     |     |
| 0.39μF (394)        | D             | D    | D  | I  |    |     |     |     |     | C    | C  | J  | P  |    |     |     |     |     |     |
| 0.47μF (474)        | D             | D    | D  | I  |    |     |     |     |     | J    | J  | J  | P  |    |     |     |     |     |     |
| 0.56μF (564)        | D             | D    | D  |    |    |     |     |     |     | J    | J  | J  | P  |    |     |     |     |     |     |
| 0.68μF (684)        | D             | D    | D  | I  |    |     |     |     |     | J    | J  | J  | P  |    |     |     |     |     |     |
| 0.82μF (824)        | D             | D    | D  |    |    |     |     |     |     | J    | J  | J  | P  |    |     |     |     |     |     |
| 1.0μF (105)         | D             | D    | D  | I  |    |     |     |     |     | J    | J  | J  | P  |    |     |     |     |     |     |
| 2.2μF (225)         |               |      |    |    |    |     |     |     |     |      |    |    |    |    |     |     |     |     |     |
| 4.7μF (475)         |               |      |    |    |    |     |     |     |     |      |    |    |    |    |     |     |     |     |     |
| 10μF (106)          |               |      |    |    |    |     |     |     |     |      |    |    |    |    |     |     |     |     |     |

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

Multilayer Ceramic Capacitors

**X7R Dielectric**

| DIELECTRIC          |               | X7R  |    |    |    |     |     |     |      |
|---------------------|---------------|------|----|----|----|-----|-----|-----|------|
| SIZE                |               | 1210 |    |    |    |     |     |     |      |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 250 | 500 | 1000 |
| Capacitance         | 100pF (101)   |      |    |    |    |     | D   | D   | D    |
|                     | 120pF (121)   |      |    |    |    |     | D   | D   | D    |
|                     | 150pF (151)   |      |    |    |    |     | D   | D   | D    |
|                     | 180pF (181)   |      |    |    |    |     | D   | D   | D    |
|                     | 220pF (221)   |      |    |    |    |     | D   | D   | D    |
|                     | 270pF (271)   |      |    |    |    |     | D   | D   | D    |
|                     | 330pF (331)   |      |    |    |    |     | D   | D   | D    |
|                     | 390pF (391)   |      |    |    |    |     | D   | D   | D    |
|                     | 470pF (471)   |      |    |    |    |     | D   | D   | D    |
|                     | 560pF (561)   |      |    |    |    |     | D   | D   | D    |
|                     | 680pF (681)   |      |    |    |    |     | C   | D   | D    |
|                     | 820pF (821)   |      |    |    |    |     | C   | D   | D    |
|                     | 1,000pF (102) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 1,200pF (122) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 1,500pF (152) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 1,800pF (182) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 2,200pF (222) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 2,700pF (272) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 3,300pF (332) | C    | C  | C  | C  | C   | C   | D   | D    |
|                     | 3,900pF (392) | C    | C  | C  | C  | C   | C   | D   | G    |
|                     | 4,700pF (472) | C    | C  | C  | C  | C   | C   | D   | G    |
|                     | 5,600pF (562) | C    | C  | C  | C  | C   | C   | D   | G    |
|                     | 6,800pF (682) | C    | C  | C  | C  | C   | C   | D   | G    |
|                     | 8,200pF (822) | C    | C  | C  | C  | C   | C   | D   | G    |
|                     | 0.010μF (103) | C    | C  | C  | C  | C   | C   | D   | G    |
|                     | 0.012μF (123) | C    | C  | C  | C  | C   | C   | D   |      |
|                     | 0.015μF (153) | C    | C  | C  | C  | C   | C   | D   |      |
|                     | 0.018μF (183) | C    | C  | C  | C  | C   | C   | D   |      |
|                     | 0.022μF (223) | C    | C  | C  | C  | C   | C   | D   |      |
|                     | 0.027μF (273) | C    | C  | C  | C  | C   | C   |     |      |
|                     | 0.033μF (333) | C    | C  | C  | C  | C   | C   |     |      |
|                     | 0.039μF (393) | C    | C  | C  | C  | C   | C   |     |      |
|                     | 0.047μF (473) | C    | C  | C  | C  | C   | D   |     |      |
|                     | 0.056μF (563) | C    | C  | C  | C  | C   |     |     |      |
|                     | 0.068μF (683) | C    | C  | C  | C  | C   |     |     |      |
|                     | 0.082μF (823) | C    | C  | C  | C  | C   |     |     |      |
|                     | 0.10μF (104)  | C    | C  | C  | C  | C   |     |     |      |
|                     | 0.12μF (124)  | C    | C  | C  | C  |     |     |     |      |
|                     | 0.15μF (154)  | C    | C  | C  | C  |     |     |     |      |
|                     | 0.18μF (184)  | C    | C  | C  | C  |     |     |     |      |
|                     | 0.22μF (224)  | C    | C  | C  | C  |     |     |     |      |
|                     | 0.27μF (274)  | C    | C  | C  | C  |     |     |     |      |
|                     | 0.33μF (334)  | C    | C  | C  | D  |     |     |     |      |
|                     | 0.39μF (394)  | C    | C  | C  | D  |     |     |     |      |
|                     | 0.47μF (474)  | C    | C  | C  | D  |     |     |     |      |
| 0.56μF (564)        | D             | D    | D  | D  |    |     |     |     |      |
| 0.68μF (684)        | D             | D    | D  | D  |    |     |     |     |      |
| 0.82μF (824)        | D             | D    | D  | D  |    |     |     |     |      |
| 1.0μF (105)         | D             | D    | D  | D  |    |     |     |     |      |
| 1.5μF (155)         |               | K    |    |    |    |     |     |     |      |
| 2.2μF (225)         |               | K    |    |    |    |     |     |     |      |
| 4.7μF (475)         |               |      |    |    |    |     |     |     |      |
| 10μF (106)          |               |      |    |    |    |     |     |     |      |

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

Multilayer Ceramic Capacitors

**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 | 15k        | 70k      | -            | -        |
| 0402 (1005) | 0.50±0.05             | N | 10k        | 50k      | -            | -        |
| 0603 (1608) | 0.80±0.07             | S | 4k         | 15k      | -            | -        |
|             | 0.80+0.15/-0.10       | X | 4k         | 15k      | -            | -        |
| 0805 (2012) | 0.60±0.10             | A | 4k         | 15k      | -            | -        |
|             | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|             | 1.25±0.20             | I | -          | -        | 3k           | 10k      |
| 1206 (3216) | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|             | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|             | 1.15±0.15             | J | -          | -        | 3k           | 10k      |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|             | 1.60±0.20             | G | -          | -        | 2k           | 10k      |
|             | 1.60+0.30/-0.10       | P | -          | -        | 2k           | 9k       |
| 1210 (3225) | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|             | 1.60±0.20             | G | -          | -        | 2k           | -        |
|             | 2.00±0.20             | K | -          | -        | 1k           | 6k       |
|             | 2.50±0.30             | M | -          | -        | 1k           | 6k       |

Unit: pieces



Multilayer Ceramic Capacitors

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.   | AEC-Q200 Test Item   | AEC-Q200 Test Condition   | Requirements   |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|---|--|---|--|---------------|-----------------------|-----------------------------|---|--|--|--|--|---|-----------------------|---|----------------------------------|---|-----|-----|--|---|--------------------|-----|-----|---|--------------------|---|-----|-----|---|--|-------------------------------|-----|-------|---|---|-------------------------------|------|------|---|---|----|------|----|
| 1.  | Pre-and Post-Stress Electrical Test                        | ---   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 2.  | High Temperature Exposure (Storage) MIL-STD-202 Method 108 | * Test temp.: 150±3°C<br>* Unpowered.<br>* Test time: 1000+24/-0 hrs.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.<br>* Cap change : NPO: within ±2.5% or ±0.25pF whichever is larger.<br>X7R: within ±10.00%.<br>* Q/D.F. value:<br>NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td rowspan="3">≤3%</td> <td>≤6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤7.5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤20% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤3%</td> <td>≤6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤5%</td> <td>≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤14% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤20% 0402 ≥ 0.47μF</td> </tr> <tr> <td>≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤7.5%</td> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤15%</td> <td>≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>--</td> </tr> </tbody> </table> | Rated vol.    | D.F. ≤                | Exception of D.F. ≤         | ≥100V                                     | ≤3%  | ≤6% 1206 ≥ 0.47μF  | ≤7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF                           | ≤20% 0805 > 0.22μF; 1210 ≥ 3.3μF   | 50V   | ≤3%                   | ≤6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤5% | ≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤14% 0603 ≥ 0.33μF | 25V | ≤5% | ≤15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤20% 0402 ≥ 0.47μF | ≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤5% | ≤15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF | 10V | ≤7.5% | ≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤15% | ≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | 4V | ≤20% | -- |
| Rated vol.  | D.F. ≤   | Exception of D.F. ≤   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| ≥100V   | ≤3%  | ≤6% 1206 ≥ 0.47μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤20% 0805 > 0.22μF; 1210 ≥ 3.3μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 50V   | ≤3%  | ≤6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 35V   | ≤5%  | ≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤14% 0603 ≥ 0.33μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 25V   | ≤5%  | ≤15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤20% 0402 ≥ 0.47μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 16V   | ≤5%  | ≤15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 10V   | ≤7.5%  | ≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 6.3V  | ≤15%   | ≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  | ≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 4V  | ≤20%   | --  |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  |   | * I.R.: ≥10GΩ or RxC≥500Ω·F whichever is smaller.<br>Class II (X7R)  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
|   |  |   | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3μF</td> <td rowspan="7">1GΩ or RxC ≥ 10 Ω·F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; Size ≥ 1812</td> </tr> </tbody> </table>   | Rated voltage | Insulation Resistance | 100V: All X7R; 1210 ≥ 3.3μF | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V; 4V; Size ≥ 1812 |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| Rated voltage   | Insulation Resistance                                      |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 100V: All X7R; 1210 ≥ 3.3μF   | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller.                  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF                  |  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                |  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF  |  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF    |  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF |  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |
| 6.3V; 4V; Size ≥ 1812   |  |   |  |               |                       |                             |   |  |  |  |  |   |                       |   |                                  |   |     |     |  |   |                    |     |     |   |                    |   |     |     |   |  |                               |     |       |   |   |                               |      |      |   |   |    |      |    |

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

Multilayer Ceramic Capacitors

| No.  | AEC-Q200 Test Item                                    | AEC-Q200 Test Condition  | Requirements |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
|--|---|--|--------------|------------|-------------|---|-------------|-----|---|--------------|-----|---|------------|--------|---------------------|-------|------|--|-----|------|---|-----|------|---|-----|------|---|-----|------|---|-----|--------|--|------|-------|---|----|-------|-----|---------------|-----------------------|-----------------------------|--|--|--|---|---|--|-----------------------|
| 3.   | <b>Temperature Cycling</b><br>JESD22<br>Method JA-104 | * Conduct 1000 cycles according to the temperatures and time.<br><table border="1"><thead><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr></thead><tbody><tr><td>1</td><td>-55°C +0/-3</td><td>5±1</td></tr><tr><td>2</td><td>+125°C +3/-0</td><td>5±1</td></tr></tbody></table> <p>* Before initial measurement (X7R only):<br/>Perform 150±0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br/>*Measurement to be made after keeping at room temp.<br/>for 24±2 hrs.</p> | Step         | Temp. (°C) | Time (min.) | 1 | -55°C +0/-3 | 5±1 | 2 | +125°C +3/-0 | 5±1 | * No remarkable damage.<br>* Cap change : NPO: within ±2.5% or 0.25pF whichever is larger.<br>X7R: within ±10.0%.<br>* Q/D.F. value:<br>NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:<br><table border="1"><thead><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr></thead><tbody><tr><td>≥100V</td><td>≤ 3%</td><td>≤ 6% 1206 ≥ 0.47μF<br/>≤ 7.5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF<br/>≤ 20% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td></tr><tr><td>50V</td><td>≤ 3%</td><td>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF<br/>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td></tr><tr><td>35V</td><td>≤ 5%</td><td>≤ 20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 / X7R &gt; 0.47μF;<br/>1206 ≥ 2.2μF; 1210 ≥ 10μF<br/>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>25V</td><td>≤ 5%</td><td>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF<br/>≤ 14% 0603 ≥ 0.33μF<br/>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF;<br/>0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF<br/>≤ 20% 0402 ≥ 0.47μF</td></tr><tr><td>16V</td><td>≤ 5%</td><td>≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF<br/>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF;<br/>0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>10V</td><td>≤ 7.5%</td><td>≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF;<br/>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF<br/>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td>6.3V</td><td>≤ 15%</td><td>≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF;<br/>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td></tr></tbody></table> <p>* I.R.: ≥10GΩ or Rx C ≥ 500Ω·F whichever is smaller.<br/>Class II (X7R)<br/><table border="1"><thead><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr></thead><tbody><tr><td>100V: All X7R; 1210 ≥ 3.3μF</td><td rowspan="7">1GΩ or<br/>RxC ≥ 10 Ω·F<br/>whichever is<br/>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;<br/>1206 ≥ 10μF; 1210 ≥ 10μF</td></tr><tr><td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF;<br/>1206 ≥ 10μF; 1210 ≥ 47μF</td></tr><tr><td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF;<br/>1206 ≥ 4.7μF; 1210 ≥ 47μF</td></tr><tr><td>6.3V; 4V; Size ≥ 1812</td></tr></tbody></table></p> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF<br>≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF<br>≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 3% | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF<br>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | 35V | ≤ 5% | ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 / X7R > 0.47μF;<br>1206 ≥ 2.2μF; 1210 ≥ 10μF<br>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | 25V | ≤ 5% | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF<br>≤ 14% 0603 ≥ 0.33μF<br>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF<br>≤ 20% 0402 ≥ 0.47μF | 16V | ≤ 5% | ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF<br>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF;<br>0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF<br>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | 4V | ≤ 20% | --- | Rated voltage | Insulation Resistance | 100V: All X7R; 1210 ≥ 3.3μF | 1GΩ or<br>RxC ≥ 10 Ω·F<br>whichever is<br>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;<br>1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF;<br>1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF;<br>1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V; 4V; Size ≥ 1812 |
| Step   | Temp. (°C)  | Time (min.)  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 1  | -55°C +0/-3   | 5±1  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 2  | +125°C +3/-0  | 5±1  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| Rated vol.   | D.F. ≤  | Exception of D.F. ≤  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| ≥100V  | ≤ 3%  | ≤ 6% 1206 ≥ 0.47μF<br>≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF<br>≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF   |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 50V  | ≤ 3%  | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF<br>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 35V  | ≤ 5%  | ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 / X7R > 0.47μF;<br>1206 ≥ 2.2μF; 1210 ≥ 10μF<br>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 25V  | ≤ 5%  | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF<br>≤ 14% 0603 ≥ 0.33μF<br>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF;<br>0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF<br>≤ 20% 0402 ≥ 0.47μF  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 16V  | ≤ 5%  | ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF<br>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF;<br>0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 10V  | ≤ 7.5%  | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF<br>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF   |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 6.3V   | ≤ 15%   | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF;<br>0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 4V   | ≤ 20%   | ---  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| Rated voltage  | Insulation Resistance                                 |  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 100V: All X7R; 1210 ≥ 3.3μF  | 1GΩ or<br>RxC ≥ 10 Ω·F<br>whichever is<br>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;<br>1206 ≥ 10μF; 1210 ≥ 10μF  |   |  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF;<br>1206 ≥ 10μF; 1210 ≥ 47μF    |   |  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF;<br>1206 ≥ 4.7μF; 1210 ≥ 47μF |   |  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |
| 6.3V; 4V; Size ≥ 1812  |   |  |              |            |             |   |             |     |   |              |     |   |            |        |                     |       |      |  |     |      |   |     |      |   |     |      |   |     |      |   |     |        |  |      |       |   |    |       |     |               |                       |                             |  |  |  |   |   |  |                       |

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

Multilayer Ceramic Capacitors

| No.  | AEC-Q200 Test Item                                   | AEC-Q200 Test Condition   | Requirements  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|--|--|---|---|-----------------------|-----------------------------|---|--|--|--|--|---|-----------------------|--|-------|-----------------------------|-----|------|------|---|-------|-----------------------------|-------|--|-----|------|-------|---|-------|--|-------|---------------|-----|------|-------|--|-------|---|-------|---------------|-------|--|-----|------|-------|--|-------|---|-------|--------------------------|-----|--------|-------|---|-------|--------------------------|------|-------|-------|--|-----|-----|----|-------|-----|-----|
| 4.   | <b>Destructive Physical Analysis</b><br>EIA-469      | Per EIA-469   | No defects or abnormalities   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 5.   | <b>Moisture Resistance</b><br>MIL-STD-202 Method 106 | * Test temp.: 25~65°C<br>* Humidity: 80~100% RH<br>* Test time: 10 cycles, t=24hrs/cycle.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.<br>* Cap change : NPO: within ±3.0% or 0.30pF whichever is larger<br>X7R: within ±12.5%.<br>* Q/D.F. value:<br>NPO: More than 30pF Q≥350 ; 10pF≤C≤30pF, Q≥275+2.5C<br>Less than 10pF Q≥200+10C<br>X7R:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5%</td> <td>0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20%</td> <td>0805 ≥ 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 5%</td> <td>≤ 20%</td> <td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 14%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 5%</td> <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>≤ 15%</td> <td>0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10%</td> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 15%</td> <td>≤ 30%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol.            | D.F. ≤                      | Exception of D.F. ≤                       |  | ≥ 100V   | ≤ 3%   | ≤ 6%   | 1206 ≥ 0.47μF   | ≤ 7.5%                | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 20% | 0805 ≥ 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 3% | ≤ 6% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 10% | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 20% | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 5% | ≤ 20% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 10% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 14% | 0603 ≥ 0.33μF | 25V | ≤ 5% | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 20% | 0402 ≥ 0.47μF | ≤ 10% | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 5% | ≤ 15% | 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 20% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | 10V | ≤ 7.5% | ≤ 15% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 20% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 15% | ≤ 30% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | --- | --- | 4V | ≤ 20% | --- | --- |
| Rated vol.   | D.F. ≤   | Exception of D.F. ≤   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| ≥ 100V   | ≤ 3%   | ≤ 6%  | 1206 ≥ 0.47μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 7.5%  | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 20%   | 0805 ≥ 0.22μF; 1210 ≥ 3.3μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 50V  | ≤ 3%   | ≤ 6%  | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 10%   | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 20%   | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 35V  | ≤ 5%   | ≤ 20%   | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 10%   | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 14%   | 0603 ≥ 0.33μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 25V  | ≤ 5%   | ≤ 10%   | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 15%   | 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 20%   | 0402 ≥ 0.47μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 10%   | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 16V  | ≤ 5%   | ≤ 15%   | 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 15%   | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 20%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 10V  | ≤ 7.5%   | ≤ 15%   | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ≤ 20%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 6.3V   | ≤ 15%  | ≤ 30%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF  |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
|  |  | ---   | ---   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 4V   | ≤ 20%  | ---   | ---   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| <p>* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br/>Class II (X7R) nce</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3μF</td> <td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; Size ≥ 1812</td> </tr> </tbody> </table> |  |   | Rated voltage   | Insulation Resistance | 100V: All X7R; 1210 ≥ 3.3μF | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V; 4V; Size ≥ 1812 |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| Rated voltage  | Insulation Resistance                                |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 100V: All X7R; 1210 ≥ 3.3μF  | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller.            |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF   |  |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |  |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF   |  |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF   |  |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF  |  |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |
| 6.3V; 4V; Size ≥ 1812  |  |   |   |                       |                             |   |  |  |  |  |   |                       |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |   |       |               |       |  |     |      |       |  |       |   |       |                          |     |        |       |   |       |                          |      |       |       |  |     |     |    |       |     |     |

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

Multilayer Ceramic Capacitors

| No.   | AEC-Q200 Test Item                           | AEC-Q200 Test Condition  | Requirements  |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|---|--|--|---|--|--|--|--|--|---|-----------------------|---------------|--------|--|-------|-----------------------------|-----|------|------|---|-------|-----------------------------|-------|--|-----|------|-------|---|-------|--|-------|---------------|-----|------|-------|--|-------|---------------|-------|--|-----|------|-------|--|-------|---|-----|--------|-------|---------------------------|-------|--------------------------|------|-------|-------|--|-----|-----|----|-------|-----|-----|
| 6.  | Biased Humidity<br>MIL-STD-202<br>Method 103 | * Test temp.: 85±3°C<br>* Humidity: 85%RH<br>* Test time: 1000+24/-0 hrs.<br>* To apply voltage : rated voltage and 1.3~1.5Vdc.<br>(add 100k ohm resistor)<br>* Before initial measurement (Class II only) : To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.<br>* Cap change: NPO: within ±3.0% or 0.30pF whichever is larger.<br>X7R: within ±12.5%<br>* Q/D.F. value:<br>NPO: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C<br>X7R:   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
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|   |  |  | Rated vol.  | D.F. ≤                                     | Exception of D.F. ≤  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  | 100V  | ≤ 3%                                       | ≤ 6%   | 1206 ≥ 0.47μF  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 7.5%   | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF                               |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 20%  | 0805 > 0.22μF; 1210 ≥ 3.3μF  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  | 50V   | ≤ 3%                                       | ≤ 6%   | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF                              |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 10%  | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 20%  | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF           |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  | 35V   | ≤ 5%                                       | ≤ 20%  | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 10%  | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF   |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 14%  | 0603 ≥ 0.33μF  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  | 25V   | ≤ 5%                                       | ≤ 15%  | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 20%  | 0402 ≥ 0.47μF  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  |  |   |  | ≤ 10%  | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF                             |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 16V   | ≤ 5%   | ≤ 15%  | 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  | ≤ 15%  | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 10V   | ≤ 7.5%                                       | ≤ 15%  | 0201 ≥ 0.01μF; 0402 ≥ 1μF   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  | ≤ 20%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF  |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 6.3V  | ≤ 15%  | ≤ 30%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF  |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  | ---  | ---   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 4V  | ≤ 20%  | ---  | ---   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
|   |  | * I.R.: ≥1GΩ or RxC≥50Ω·F whichever is smaller.<br>Class II (X7R) for rated voltage test   |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
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| 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; Size ≥ 1812   |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| Class II (X7R) for 1.3~1.5Vdc   |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3μF</td> <td rowspan="7">1GΩ or RxC ≥ 10 Ω·F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; Size ≥ 1812</td> </tr> </tbody> </table>  | Rated voltage                                | Insulation Resistance  | 100V: All X7R; 1210 ≥ 3.3μF   | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller.  | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                             | 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF | 6.3V; 4V; Size ≥ 1812 |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| Rated voltage   | Insulation Resistance                        |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 100V: All X7R; 1210 ≥ 3.3μF   | 1GΩ or RxC ≥ 10 Ω·F whichever is smaller.    |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF  |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF  |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF  |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF   |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |
| 6.3V; 4V; Size ≥ 1812   |  |  |   |  |  |  |  |  |   |                       |               |        |  |       |                             |     |      |      |   |       |                             |       |  |     |      |       |   |       |  |       |               |     |      |       |  |       |               |       |  |     |      |       |  |       |   |     |        |       |                           |       |                          |      |       |       |  |     |     |    |       |     |     |

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

Multilayer Ceramic Capacitors

| No.        | AEC-Q200 Test Item                            | AEC-Q200 Test Condition   | Requirements  |  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
|------------|---|---|---|--|--------|---------------------|--------|------|--|-----|------|---|-----|------|--|-----|------|---|-----|------|--|-----|--------|---|------|-------|--|
| 7.         | Operational Life<br>MIL-STD-202<br>Method 108 | * Test temp.: 125±3°C<br>* To apply voltage:<br>(1) 10V≤Ur≤250V:200% of rated voltage.<br>(2) 150% of rated voltage:<br>a) 500V<br>b) 0603/X7R/50V/Cap.>0.1μF<br>c) 0805/X7R/50V/Cap.≥0.68μF<br>(3) 630V≤Ur≤1000V:120% of rated voltage.<br>* Test time: 1000+24/0 hrs.<br>* Before initial measurement (X7R only):<br>Apply test voltage for 1 hr at 125°C.<br>Remove and let 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: NPO: within ±3.0% or ±0.3pF whichever is larger<br>X7R: within ±12.5%.<br>* Q/D.F. value:<br>NPO: More than 30pF, Q≥350 ; 10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF, Q≥200+10C<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="3">≥ 100V</td> <td>≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47μF<br/>≤ 7.5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF<br/>≤ 20% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤ 3%</td> <td>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF<br/>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF<br/>≤ 20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td>≤ 5%</td> <td>≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF<br/>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF<br/>≤ 14% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤ 5%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF<br/>≤ 20% 0402 ≥ 0.47μF</td> </tr> <tr> <td rowspan="3">16V</td> <td>≤ 5%</td> <td>≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF<br/>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td>≤ 7.5%</td> <td>≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF<br/>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td>≤ 15%</td> <td>≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>--</td> </tr> </tbody> </table> | Rated vol.   | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF<br>≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF<br>≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 3% | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF<br>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF<br>≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 5% | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF<br>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF<br>≤ 14% 0603 ≥ 0.33μF | 25V | ≤ 5% | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF<br>≤ 20% 0402 ≥ 0.47μF | 16V | ≤ 5% | ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF<br>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF<br>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF |
| Rated vol. | D.F. ≤  | Exception of D.F. ≤   |   |  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
| ≥ 100V     | ≤ 3%  | ≤ 6% 1206 ≥ 0.47μF<br>≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF<br>≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF  |   |  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
|            | 50V   | ≤ 3%  | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF<br>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF<br>≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
|            |   | 35V   | ≤ 5%  | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF<br>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF<br>≤ 14% 0603 ≥ 0.33μF                               |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
| 25V        |   |   | ≤ 5%  | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF<br>≤ 20% 0402 ≥ 0.47μF  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
|            | 16V   |   | ≤ 5%  | ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF<br>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
|            |   | 10V   | ≤ 7.5%  | ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF<br>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF                                  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
| 6.3V       |   |   | ≤ 15%   | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
|            | 4V  |   | ≤ 20%   | --   |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
| 8.         | External Visual<br>MIL-STD-883<br>Method 2009 | Visual inspection   | No remarkable defect.   |  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |
| 9.         | Physical Dimension<br>JESD22<br>Method JB-100 | Using by calipers   | Within the specified dimensions   |  |        |                     |        |      |  |     |      |   |     |      |  |     |      |   |     |      |  |     |        |   |      |       |  |

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



Multilayer Ceramic Capacitors

| No.   | AEC-Q200 Test Item                                  | AEC-Q200 Test Condition  | Requirements  |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|---|---|--|---|------------|---------------------|---|--|--------|--------|------|---------------|------|--|-------|-----------------------------|-----|--------|------|---|------|-----------------------------|-------|--|-----|--------|-------|---|------|--|-----|--------|------|---------------|-------|--|---------|---------------|------|---|-----|--------|-------|---|-------|---|-----|------|-------|--------------------------|-------|--|------|-------|-------|--------------|-------|----|----|-------|----|----|
| 10.   | Resistance to Solvents<br>MIL-STD-202<br>Method 215 | * Temperature: 25±5°C<br>* Time: 3+0.5/-0 min.<br>* Solvent: Iso-propyl alcohol. | * No remarkable damage.<br>* Cap.: within the specified tolerance.<br>* Q/D.F. value:<br>NPO: 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 colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>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="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤ 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 rowspan="4">25V</td> <td rowspan="4">≤ 3.5%</td> <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>≤ 12.5%</td> <td>0402 ≥ 0.47μF</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 rowspan="2">16V</td> <td rowspan="2">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 5%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 15%</td> <td>--</td> </tr> <tr> <td rowspan="2">4V</td> <td rowspan="2">≤ 15%</td> <td>--</td> <td>--</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤              | Exception of D.F. ≤   |  | ≥ 100V | ≤ 2.5% | ≤ 3% | 1206 ≥ 0.47μF | ≤ 5% | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 10% | 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 2.5% | ≤ 3% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 10% | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | 25V | ≤ 3.5% | ≤ 7% | 0603 ≥ 0.33μF | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% | 0402 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | 10V | ≤ 5% | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | 6.3V | ≤ 10% | ≤ 20% | 0402 ≥ 2.2μF | ≤ 15% | -- | 4V | ≤ 15% | -- | -- |
|   |   |  | Rated vol.  | D.F. ≤     | Exception of D.F. ≤ |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | ≥ 100V  | ≤ 2.5%     | ≤ 3%                | 1206 ≥ 0.47μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 5%                | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF                                  |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 10%               | 0805 > 0.22μF; 1210 ≥ 3.3μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | 50V   | ≤ 2.5%     | ≤ 3%                | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF                                 |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 5%                | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 10%               | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                  |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | 35V   | ≤ 3.5%     | ≤ 10%               | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 5%                | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF  |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | 25V   | ≤ 3.5%     | ≤ 7%                | 0603 ≥ 0.33μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 10%               | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF    |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 12.5%             | 0402 ≥ 0.47μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 5%                | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | 16V   | ≤ 3.5%     | ≤ 10%               | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 15%               | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | 10V   | ≤ 5%       | ≤ 15%               | 0201 ≥ 0.1μF; 0402 ≥ 1μF  |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  |   |            | ≤ 10%               | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF          |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   |  | 6.3V  | ≤ 10%      | ≤ 20%               | 0402 ≥ 2.2μF  |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| ≤ 15%   | --  |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 4V  | ≤ 15%   | --   | --  |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
|   |   | * I.R.: ≥10GΩ or RxC≥500Ω·F whichever is smaller.                                |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| Class II (X7R)  |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| Rated voltage   |   | Insulation Resistance  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 100V: All X7R   |   | 10GΩ or RxC≥100 Ω·F whichever is smaller.  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF                |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF                                      |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF                 |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF    |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 6.3V; 4V; Size≥1812   |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| Rated voltage   |   | Insulation Resistance  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 100V: 1210≥3.3μF  |   | RxC≥50 Ω·F.  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |
| 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  |   |  |   |            |                     |   |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |                          |       |  |      |       |       |              |       |    |    |       |    |    |

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

Multilayer Ceramic Capacitors

| No. | AEC-Q200 Test Item  | AEC-Q200 Test Condition                                  | Requirements   |
|-----|---|--|--|
| 11. | Mechanical Shock<br>MIL-STD-202<br>Method 213   | * Peak value: 1500g's.                                   | * No remarkable damage.  |
|     |   | * Wave: 1/2 sine.  | * Cap.: within the specified tolerance.                                      |
|     |   | * Velocity: 15.4 ft/sec                                  | * Q/D.F. value:  |
|     |   | * Three shocks in each direction should be applied along | NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.                                 |
|     |   | 3 mutually perpendicular axes of the test specimen       | X7R:   |
|     |   | (18 shocks)  |  |
|     |   |  | Rated vol. D.F. ≤ Exception of D.F. ≤  |
|     |   |  | ≥ 100V ≤ 2.5% ≤ 3% 1206 ≥ 0.47μF   |
|     |   |  | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF                  |
|     |   |  | ≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF  |
|     |   |  | 50V ≤ 2.5% ≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF      |
|     |   |  | ≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF   |
|     |   |  | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF |
|     |   |  | 35V ≤ 3.5% ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF         |
|     |   |  | ≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF                                  |
|     | 25V ≤ 3.5% ≤ 7% 0603 ≥ 0.33μF   |  |  |
|     | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF              |  |  |
|     | ≤ 12.5% 0402 ≥ 0.47μF   |  |  |
|     | 16V ≤ 3.5% ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF |  |  |
|     | ≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF             |  |  |
|     | 10V ≤ 5% ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF    |  |  |
|     | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF  |  |  |
|     | 6.3V ≤ 10% ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF         |  |  |
|     | ≤ 20% 0402 ≥ 2.2μF  |  |  |
|     | 4V ≤ 15% ---  |  |  |
|     | * I.R.: ≥ 10GΩ or RxC ≥ 500Ω·F whichever is smaller.  |  |  |
|     | Class II (X7R)  |  |  |
|     | Rated voltage Insulation Resistance   |  |  |
|     | 100V: All X7R   | 10GΩ or RxC ≥ 100 Ω·F whichever is smaller.              |  |
|     | 50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF                                  |  |  |
|     | 35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |  |  |
|     | 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF                                   |  |  |
|     | 16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF                    |  |  |
|     | 10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF                 |  |  |
|     | 6.3V; 4V; Size ≥ 1812   |  |  |
|     | Rated voltage Insulation Resistance   | RxC ≥ 50 Ω·F.  |  |
|     | 100V: 1210 ≥ 3.3μF  |  |  |
|     | 50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF   |  |  |
|     | 35V: 0603 ≥ 1μF;  |  |  |
|     | 25V: 0201 ≥ 0.1μF; 0402 ≥ 2.2μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF                                  |  |  |
|     | 16V: 0603 ≥ 10μF; 0402 ≥ 1μF; 0201 ≥ 0.22μF   |  |  |
|     | 10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF   |  |  |
|     | 6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF                                  |  |  |
|     | 4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF  |  |  |

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

Multilayer Ceramic Capacitors

| No.        | AEC-Q200 Test Item                     | AEC-Q200 Test Condition  | Requirements  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|------------|--|--|---|------------|--------|---------------------|--|--------|--------|------|---------------|------|--|-------|-----------------------------|-----|--------|------|---|------|-----------------------------|-------|--|-----|--------|-------|---|------|--|------|---------------|-----|--------|-------|--|---------|---------------|------|---|-----|--------|-------|---|-------|---|-------|--------------------------|------|-------|-------|--|-------|--------------|-----|-----|----|-------|-----|-----|
| 12.        | Vibration<br>MIL-STD-202<br>Method 204 | * Vibration frequency: 10~2000 Hz/min.<br>(5g's for 20 min)<br>* Total amplitude: 1.5mm<br>* 12 cycles each of 3 orientations (36 times) | No remarkable damage.<br>Cap.: within the specified tolerance.<br>Q/D.F. value:<br>NPO:Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 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 rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 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 rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <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>≤ 12.5%</td> <td>0402 ≥ 0.47μF</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 rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 15%</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>---</td> <td>---</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥ 100V | ≤ 2.5% | ≤ 3% | 1206 ≥ 0.47μF | ≤ 5% | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 10% | 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 2.5% | ≤ 3% | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 10% | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 7% | 0603 ≥ 0.33μF | 25V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% | 0402 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 10% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 10% | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 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   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
| 50V        | ≤ 2.5%                                 | ≤ 3%   | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 5%   | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 10%  | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
| 35V        | ≤ 3.5%                                 | ≤ 10%  | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 5%   | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 7%   | 0603 ≥ 0.33μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
| 25V        | ≤ 3.5%                                 | ≤ 10%  | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 12.5%  | 0402 ≥ 0.47μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 5%   | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
| 16V        | ≤ 3.5%                                 | ≤ 10%  | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 10%  | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 15%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
| 6.3V       | ≤ 10%                                  | ≤ 15%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ≤ 20%  | 0402 ≥ 2.2μF  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | ---  | ---   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
| 4V         | ≤ 15%                                  | ---  | ---   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  |  | * I.R.: ≥10GΩ or RxC≥500Ω·F whichever is smaller.   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  |  | Class II (X7R)  |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | Rated voltage  | Insulation Resistance   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 100V: All X7R  | 10GΩ or RxC≥100 Ω·F whichever is smaller.   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF   |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF   |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF  |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF   |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF  |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 6.3V; 4V; Size≥1812  |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | Rated voltage  | Insulation Resistance   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 100V: 1210≥3.3μF   | RxC≥50 Ω·F.   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |
|            |  | 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   |   |            |        |                     |  |        |        |      |               |      |  |       |                             |     |        |      |   |      |                             |       |  |     |        |       |   |      |  |      |               |     |        |       |  |         |               |      |   |     |        |       |   |       |   |       |                          |      |       |       |  |       |              |     |     |    |       |     |     |

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

Multilayer Ceramic Capacitors

| No.  | AEC-Q200 Test Item  | AEC-Q200 Test Condition  | Requirements   |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|--|---|--|--|------------------|---|--|--|--|--|---|--|--|--|---------------|-----------------------------|------------------|-------------|---|---|--|---------------------------------------|---|--|--------------------------------------|--------|-------|---|------|--|-----|--------|------|---------------|-------|--|---------|---------------|------|---|-----|--------|-------|---|-------|---|-----|------|-------|---|-------|--------------------------|------|-------|-------|--|-------|--------------|----|-------|-----|-----|
| 13.  | <b>Resistance to Soldering Heat</b><br>MIL-STD-202 Method 210                           | * Solder temperature: 260±5°C<br>* Dipping time: 10±1 sec<br>* Before initial measurement (X7R only): Perform 150+0/-10°C for 1 hr and 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: NPO: within ±2.5% or 0.25pF whichever is larger<br>X7R: within ±7.5%<br>* Q/D.F. value:<br>NPO: 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 colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>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="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤ 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 rowspan="4">25V</td> <td rowspan="4">≤ 3.5%</td> <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>≤ 12.5%</td> <td>0402 ≥ 0.47μF</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 rowspan="2">16V</td> <td rowspan="2">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 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 rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol.       | D.F. ≤                                    | Exception of D.F. ≤  |  | ≥ 100V   | ≤ 2.5%   | ≤ 3%  | 1206 ≥ 0.47μF  | ≤ 5%   | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 10%         | 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V              | ≤ 2.5%      | ≤ 3%  | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 5%   | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF           | ≤ 10%   | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V                                  | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5% | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | 25V | ≤ 3.5% | ≤ 7% | 0603 ≥ 0.33μF | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% | 0402 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | 10V | ≤ 5% | ≤ 10% | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 10% | ≤ 15% | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 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  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  | 50V  | ≤ 2.5%           | ≤ 3%                                      | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF                              |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  |  |                  | ≤ 5%                                      | 0201 ≥ 0.01μF; 1210 ≥ 3.3μF  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  |  |                  | ≤ 10%                                     | 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF               |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  | 35V  | ≤ 3.5%           | ≤ 10%                                     | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  |  |                  | ≤ 5%                                      | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF   |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  | 25V  | ≤ 3.5%           | ≤ 7%                                      | 0603 ≥ 0.33μF  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   |  |  |                  | ≤ 10%                                     | 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| ≤ 12.5%  | 0402 ≥ 0.47μF   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| ≤ 5%   | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 16V  | ≤ 3.5%  | ≤ 10%  | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   | ≤ 15%  | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 10V  | ≤ 5%  | ≤ 10%  | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   | ≤ 15%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF   |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 6.3V   | ≤ 10%   | ≤ 15%  | 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
|  |   | ≤ 20%  | 0402 ≥ 2.2μF   |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 4V   | ≤ 15%   | ---  | ---  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| * I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)  |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R</td> <td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402&gt;0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF</td> </tr> <tr> <td>6.3V; 4V; Size≥1812</td> </tr> <tr> <td colspan="2"> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: 1210≥3.3μF</td> <td rowspan="8">RxC≥50 Ω-F.</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> </td> </tr> </tbody> </table> |   | Rated voltage  | Insulation Resistance  | 100V: All X7R    | 10GΩ or RxC≥100 Ω-F whichever is smaller. | 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF                         | 35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF | 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF  | 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF | 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF | 6.3V; 4V; Size≥1812  | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: 1210≥3.3μF</td> <td rowspan="8">RxC≥50 Ω-F.</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: 1210≥3.3μF | RxC≥50 Ω-F. | 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≥100 Ω-F whichever is smaller.   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF   |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF   |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF  |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF   |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF  |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 6.3V; 4V; Size≥1812  |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
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| Rated voltage  | Insulation Resistance   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 100V: 1210≥3.3μF   | RxC≥50 Ω-F.   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |
| 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   |   |  |  |                  |   |  |  |  |  |   |  |  |  |               |                             |                  |             |   |   |  |                                       |   |  |                                      |        |       |   |      |  |     |        |      |               |       |  |         |               |      |   |     |        |       |   |       |   |     |      |       |   |       |                          |      |       |       |  |       |              |    |       |     |     |

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

Multilayer Ceramic Capacitors

| No.   | AEC-Q200 Test Item                         | AEC-Q200 Test Condition  | Requirements  |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|---|--|--|---|---------------|-----------------------|---------------------------|---|--|--|--|--|--|---------------------|--------|---------------------|--------|------|--------------------|---|-----------------------------------|-----|------|--|-----------------------------------|--|-----|------|---|--|---------------------|-----|------|--|-------|---------------------|--|-----|------|--|-------|---|-----|--------|--|-------|--------------------------|------|-------|--|-----|----|-------|-----|
| 14  | Thermal Shock<br>MIL-STD-202<br>Method 107 | <p>* Conduct 300 cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C +0/-3</td> <td>15±3</td> </tr> <tr> <td>2</td> <td>+125°C +3/-0</td> <td>15±3</td> </tr> </tbody> </table> <p>* Max. transfer time: 20 sec.</p> <p>* Before initial measurement (X7R only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs.</p> | Step  | Temp. (°C)    | Time (min.)           | 1                         | -55°C +0/-3                               | 15±3   | 2  | +125°C +3/-0   | 15±3   | <p>* No remarkable damage.</p> <p>* Cap change : NPO: within ±2.5% or 0.25pF whichever is larger<br/>X7R: within ±10.0%</p> <p>* Q/D.F. value:<br/>NPO: Cap≥30pF, Q≥1000 ; Cap&lt;30pF, Q≥400+20C.<br/>X7R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 5%</td> <td>≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 14% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 5%</td> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.47μF</td> </tr> <tr> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> </tr> <tr> <td>≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 7.5%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20%</td> </tr> <tr> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 15%</td> <td>≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>---</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> </tr> </tbody> </table> <p>* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</p> | Rated vol.          | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 3% | ≤ 6% 1206 ≥ 0.47μF | ≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 3% | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 5% | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 14% 0603 ≥ 0.33μF | 25V | ≤ 5% | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | ≤ 20% 0402 ≥ 0.47μF | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 5% | ≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 15% | ≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | 10V | ≤ 7.5% | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | ≤ 20% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | 6.3V | ≤ 15% | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF | --- | 4V | ≤ 20% | --- |
|   |  |  | Step  | Temp. (°C)    | Time (min.)           |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  | 1   | -55°C +0/-3   | 15±3                  |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  | 2   | +125°C +3/-0  | 15±3                  |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  | Rated vol.  | D.F. ≤        | Exception of D.F. ≤   |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| ≥ 100V  | ≤ 3%                                       | ≤ 6% 1206 ≥ 0.47μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 50V   | ≤ 3%                                       | ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 35V   | ≤ 5%                                       | ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 14% 0603 ≥ 0.33μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 25V   | ≤ 5%                                       | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 15%  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 20% 0402 ≥ 0.47μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 16V   | ≤ 5%                                       | ≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 15%  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 10V   | ≤ 7.5%                                     | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ≤ 20%  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | 0201 ≥ 0.1μF; 0402 ≥ 1μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 6.3V  | ≤ 15%                                      | ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF   |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  | ---  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 4V  | ≤ 20%                                      | ---  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  | Class II (X7R)  |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  | <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="8">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; Size≥1812</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; Size≥1812 |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| Rated voltage   | Insulation Resistance                      |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 100V: All X7R; 1210≥3.3μF   | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller.  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF                |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 35V: 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF                            |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 25V: 0201≥0.1μF; 0402≥0.22μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF  |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF    |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
| 6.3V; 4V; Size≥1812   |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |
|   |  |  |   |               |                       |                           |   |  |  |  |  |  |                     |        |                     |        |      |                    |   |                                   |     |      |  |                                   |  |     |      |   |  |                     |     |      |  |       |                     |  |     |      |  |       |   |     |        |  |       |                          |      |       |  |     |    |       |     |

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

Multilayer Ceramic Capacitors

| No.   | AEC-Q200 Test Item                         | AEC-Q200 Test Condition  | Requirements   |             |  |
|---|--|--|--|-------------|--|
| 15.   | ESD<br>AEC-Q200-002                        | Per AEC-Q200-002   | No remarkable damage.  |             |  |
|   |  |  | Cap.: within the specified tolerance.  |             |  |
|   |  |  | Q/D.F. value:  |             |  |
|   |  |  | NPO: Cap $\geq$ 30pF, Q $\geq$ 1000 ; Cap $<$ 30pF, Q $\geq$ 400+20C.  |             |  |
|   |  |  | X7R:   |             |  |
|   |  |  | Rated vol.   | D.F. $\leq$ | Exception of D.F. $\leq$   |
|   |  |  | $\geq$ 100V  | $\leq$ 2.5% | $\leq$ 3% 1206 $\geq$ 0.47 $\mu$ F<br>$\leq$ 5% 0603 $\geq$ 0.068 $\mu$ F; 0805 $>$ 0.1 $\mu$ F; 1206 $\geq$ 1 $\mu$ F; 1210 $\geq$ 2.2 $\mu$ F<br>$\leq$ 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<br>$\leq$ 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 $>$ 0.47 $\mu$ F;<br>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<br>$\leq$ 5% 0201 $\geq$ 0.01 $\mu$ F; 0805 $\geq$ 1 $\mu$ F; 1210 $\geq$ 10 $\mu$ F<br>$\leq$ 7% 0603 $\geq$ 0.33 $\mu$ F  |
|   |  |  | 25V  | $\leq$ 3.5% | $\leq$ 10% 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 0.056 $\mu$ F; 0603 $\geq$ 0.47 $\mu$ F;<br>0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 22 $\mu$ F<br>$\leq$ 12.5% 0402 $\geq$ 0.47 $\mu$ F  |
|   |  |  |  |             | 16V $\leq$ 3.5% $\leq$ 5% 0201 $\geq$ 0.01 $\mu$ F; 0402 $\geq$ 0.033 $\mu$ F; 0603 $\geq$ 0.15 $\mu$ F;<br>0805 $\geq$ 0.68 $\mu$ F; 1206 $\geq$ 2.2 $\mu$ F; 1210 $\geq$ 4.7 $\mu$ F<br>$\leq$ 10% 0201 $\geq$ 0.022 $\mu$ F; 0402 $\geq$ 0.22 $\mu$ F; 0603 $>$ 0.47 $\mu$ F;<br>0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 22 $\mu$ F |
|   |  |  |  |             | 10V $\leq$ 5% $\leq$ 10% 0201 $\geq$ 0.012 $\mu$ F; 0402 $\geq$ 0.22 $\mu$ F; 0603 $\geq$ 0.33 $\mu$ F;<br>0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 2.2 $\mu$ F; 1210 $\geq$ 22 $\mu$ F<br>$\leq$ 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;<br>0805 $\geq$ 4.7 $\mu$ F; 1206 $\geq$ 47 $\mu$ F; 1210 $\geq$ 100 $\mu$ F<br>$\leq$ 20% 0402 $\geq$ 2.2 $\mu$ F   |
|   |  |  |  |             | 4V $\leq$ 15% ---  |
| * I.R.: $\geq$ 10G $\Omega$ or Rx $C \geq$ 500 $\Omega \cdot F$ whichever is smaller.   |  |  |  |             |  |
| Class II (X7R)  |  |  |  |             |  |
| Rated voltage   |  | Insulation Resistance  |  |             |  |
| 100V: All X7R   |  | 10G $\Omega$ or Rx $C \geq$ 100 $\Omega \cdot F$ whichever is smaller.   |  |             |  |
| 50V: 0402 $>$ 0.01 $\mu$ F; 0603 $\geq$ 1 $\mu$ F; 0805 $\geq$ 1 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 4.7 $\mu$ F                                |  |  |  |             |  |
| 35V: 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 2.2 $\mu$ F; 1210 $\geq$ 10 $\mu$ F   |  |  |  |             |  |
| 25V: 0402 $\geq$ 1 $\mu$ F; 0603 $\geq$ 2.2 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 10 $\mu$ F; 1210 $\geq$ 10 $\mu$ F                              |  |  |  |             |  |
| 16V: 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 0.22 $\mu$ F; 0603 $\geq$ 1 $\mu$ F;<br>0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 10 $\mu$ F; 1210 $\geq$ 47 $\mu$ F |  |  |  |             |  |
| 10V: 0201 $\geq$ 47nF; 0402 $\geq$ 0.47 $\mu$ F; 0603 $\geq$ 0.47 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F;<br>1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 47 $\mu$ F    |  |  |  |             |  |
| 6.3V, 4V; Size $\geq$ 1812  |  |  |  |             |  |
| Rated voltage   |  | Insulation Resistance  |  |             |  |
| 100V: 1210 $\geq$ 3.3 $\mu$ F   |  | Rx $C \geq$ 50 $\Omega \cdot F$ .  |  |             |  |
| 50V: 0402 $\geq$ 0.1 $\mu$ F; 0603 $\geq$ 2.2 $\mu$ F; 0805 $\geq$ 10 $\mu$ F; 1206 $\geq$ 10 $\mu$ F   |  |  |  |             |  |
| 35V: 0603 $\geq$ 1 $\mu$ F;   |  |  |  |             |  |
| 25V: 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 2.2 $\mu$ F; 0603 $\geq$ 10 $\mu$ F; 0805 $\geq$ 10 $\mu$ F; 1206 $\geq$ 22 $\mu$ F                             |  |  |  |             |  |
| 16V: 0603 $\geq$ 10 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0201 $\geq$ 0.22 $\mu$ F  |  |  |  |             |  |
| 10V: 0201 $>$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0603 $\geq$ 10 $\mu$ F; 0805 $\geq$ 47 $\mu$ F  |  |  |  |             |  |
| 6.3V: 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0603 $>$ 4.7 $\mu$ F; 0805 $\geq$ 47 $\mu$ F; 1206 $\geq$ 10 $\mu$ F                                |  |  |  |             |  |
| 4V: 0603 $\geq$ 22 $\mu$ F; 0805 $\geq$ 47 $\mu$ F; 1206 $\geq$ 100 $\mu$ F   |  |  |  |             |  |
| 16.   | Solderability<br>J-STD-002<br>JESD22-B102E | * Condition A  | All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination. |             |  |
|   |  | Un-mounted chips 4hrs / 155°C* dry then completely immersed for 5 $\pm$ 0.5 sec in solder bath at 235 $\pm$ 5°C. |  |             |  |
|   |  | * Condition B  |  |             |  |
|   |  | Un-mounted chips steam 8 hrs then completely immersed for 10 $\pm$ 1sec in solder bath at 215+5/-0°C.            |  |             |  |
| * Condition C   |  |  |  |             |  |
| Un-mounted chips steam 8 hrs then completely immersed for 10 $\pm$ 1 sec. in solder bath at 260+0/-5°C.   |  |  |  |             |  |

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

Multilayer Ceramic Capacitors

| No.   | AEC-Q200 Test Item   | AEC-Q200 Test Condition   | Requirements  |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|---|--|---|---|--------|---------------------|--|--------|--------|------|---------------|------|---|-------|----------------------------|-----|--------|------|---|------|----------------------------|-------|--|-----|--------|-------|--|------|--------------------------------------|------|---------------|-----|--------|-------|---|---------|---------------|------|---|-----|--------|-------|--|-------|---|-----|------|-------|--------------------------|-------|--|------|-------|-------|--------------|-------|--------------|----|-------|-----|-----|--|---------------|-----------------------|---------------|---|--|--------------------------------------|---|--|---|---------------------|--|---------------|-----------------------|------------------|-------------|--|----------------|--|-------------------------------------|--|--|------------------------------------|
| 17.   | <b>Electrical Characterization</b><br><br>* Capacitance<br>* Q/ D.F. (Dissipation Factor)<br>*Test temp.: Room Temperature.<br>Class I: (NP0)<br>Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%<br>Cap>1000pF 1.0±0.2Vrms, 1KHz±10%<br>Class II: (X7R)<br>Cap ≤10μF, 1.0±0.2Vrms · 1KHz±10%<br>Cap > 10μF, 0.5±0.2Vrms · 120Hz±20% | * Capacitance within the specified tolerance.<br>* Q/D.F. value:<br>NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 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 rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF;1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF;0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 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 rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <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>≤ 12.5%</td> <td>0402 ≥ 0.47μF</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 rowspan="2">16V</td> <td rowspan="2">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.22μF;0603 &gt; 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td rowspan="2">4V</td> <td rowspan="2">≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated vol.  | D.F. ≤ | Exception of D.F. ≤ |  | ≥ 100V | ≤ 2.5% | ≤ 3% | 1206 ≥ 0.47μF | ≤ 5% | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF | ≤ 10% | 0805 > 0.22μF;1210 ≥ 3.3μF | 50V | ≤ 2.5% | ≤ 3% | 0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF;1210 ≥ 3.3μF | ≤ 10% | 0402 ≥ 0.012μF;0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF | 35V | ≤ 3.5% | ≤ 10% | 0603 ≥ 1μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF | ≤ 5% | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF | ≤ 7% | 0603 ≥ 0.33μF | 25V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.1μF;0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% | 0402 ≥ 0.47μF | ≤ 5% | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF;0603 > 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF | ≤ 15% | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF | 10V | ≤ 5% | ≤ 10% | 0201 ≥ 0.1μF; 0402 ≥ 1μF | ≤ 15% | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF | 6.3V | ≤ 10% | ≤ 15% | 0402 ≥ 2.2μF | ≤ 20% | 0402 ≥ 2.2μF | 4V | ≤ 15% | --- | --- | * IR. ≥10GΩ or RxC≥500Ω·F whichever is smaller.<br>Class II (X7R)<br><table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R</td> <td rowspan="6">10GΩ or RxC≥100 Ω·F whichever is smaller.</td> </tr> <tr> <td>50V: 0402≥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> <td>Rated voltage</td> <td>Insulation Resistance</td> </tr> <tr> <td>100V: 1210≥3.3μF</td> <td rowspan="7">RxC≥50 Ω·F.</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≥100 Ω·F whichever is smaller. | 50V: 0402≥0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF | 35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF | 25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF | 16V: 0201≥0.1μF;0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF | 10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF | 6.3V; 4V; Size≥1812 |  | Rated voltage | Insulation Resistance | 100V: 1210≥3.3μF | RxC≥50 Ω·F. | 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 vol.  | D.F. ≤ | Exception of D.F. ≤ |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   | ≥ 100V  | ≤ 2.5% | ≤ 3%                | 1206 ≥ 0.47μF  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   |   |        | ≤ 5%                | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF                  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   |   |        | ≤ 10%               | 0805 > 0.22μF;1210 ≥ 3.3μF   |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   | 50V   | ≤ 2.5% | ≤ 3%                | 0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF                |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   |   |        | ≤ 5%                | 0201 ≥ 0.01μF;1210 ≥ 3.3μF   |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   |   |        | ≤ 10%               | 0402 ≥ 0.012μF;0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   | 35V   | ≤ 3.5% | ≤ 10%               | 0603 ≥ 1μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                     |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  |   |   |        | ≤ 5%                | 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF                                 |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| ≤ 7%  | 0603 ≥ 0.33μF  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 25V   | ≤ 3.5%   | ≤ 10%   | 0201 ≥ 0.1μF;0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | ≤ 12.5%   | 0402 ≥ 0.47μF   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | ≤ 5%  | 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 16V   | ≤ 3.5%   | ≤ 10%   | 0201 ≥ 0.022μF; 0402 ≥ 0.22μF;0603 > 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF  |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | ≤ 15%   | 0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 10V   | ≤ 5%   | ≤ 10%   | 0201 ≥ 0.1μF; 0402 ≥ 1μF  |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | ≤ 15%   | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF  |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 6.3V  | ≤ 10%  | ≤ 15%   | 0402 ≥ 2.2μF  |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | ≤ 20%   | 0402 ≥ 2.2μF  |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 4V  | ≤ 15%  | ---   | ---   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | Rated voltage   | Insulation Resistance   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 100V: All X7R   | 10GΩ or RxC≥100 Ω·F whichever is smaller.  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 50V: 0402≥0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF                |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF                                    |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF                 |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 16V: 0201≥0.1μF;0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF    |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 6.3V; 4V; Size≥1812   |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| Rated voltage   | Insulation Resistance  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 100V: 1210≥3.3μF  | RxC≥50 Ω·F.  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
| 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                                      |  |   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | * Insulation Resistance<br>*Test temp.: Room Temperature.<br>*To apply rated voltage(500V max.) for max. 120 sec.   |   |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |
|   |  | * Dielectric Strength<br>To apply voltage:<br>≤ 100                      ≥2.5 times VDC<br>200V~300V                ≥2 times VDC<br>400V~450V                ≥1.2 times VDC<br>500V~999V                ≥1.5 times VDC<br>1000V~3000V              ≥1.2 times VDC<br>, duration 1~5 sec,<br>charge and discharge current less than 50mA.<br>* Temperature Coefficient (with no electrical load)<br>Operation temperature: -55~125°C at 25°C   | * Dielectric strength<br>No evidence of damage or flash over during test.<br><br>* Temperature Coefficient<br>Capacitance Change: NPO: Within ±30ppm/°C<br>X7R: Within ±15% |        |                     |  |        |        |      |               |      |   |       |                            |     |        |      |   |      |                            |       |  |     |        |       |  |      |                                      |      |               |     |        |       |   |         |               |      |   |     |        |       |  |       |   |     |      |       |                          |       |  |      |       |       |              |       |              |    |       |     |     |  |               |                       |               |   |  |                                      |   |  |   |                     |  |               |                       |                  |             |  |                |  |                                     |  |  |                                    |

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

Multilayer Ceramic Capacitors

| No.        | AEC-Q200 Test Item                       | AEC-Q200 Test Condition  | Requirements  |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|------------|--|--|---|------------|--------|---------------------|--------|--------|--------------------|---|-----------------------------------|-----|--------|--|----------------------------------|--|-----|--------|---|---|--------------------|-----|--------|--|-----------------------|--|-----|--------|---|---|--------------------------------|-----|------|--|--------------------|-------|------|-------|--|--------------------|-------|----|-------|-------|-------|-------|
| 18.        | <b>Board Flex</b><br>AEC-Q200-005        | * 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 3mm (2mm for X7R) and then the pressure shall be maintained for 60±1 sec.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.<br>* Cap change : NPO: within ±5% or 0.5pF whichever is larger<br>X7R: within ±12.5%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 19.        | <b>Terminal Strength</b><br>AEC-Q200-006 | * Pressurizing force : 2N (0201 & 0402), 10N(0603), 18N(≥0805).<br>* Test time: 60±1 sec.  | * No remarkable damage or removal of the terminations.<br>* Capacitance within the specified tolerance.<br>* Q/D.F. value:<br>NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:<br><table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 10% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5% 0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>-- --</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>-- --</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤ 15%</td> <td>-- --</td> </tr> <tr> <td>-- --</td> </tr> <tr> <td>-- --</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | ≥ 100V | ≤ 2.5% | ≤ 3% 1206 ≥ 0.47μF | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF | ≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF | 50V | ≤ 2.5% | ≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF | ≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | 35V | ≤ 3.5% | ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF | ≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF | ≤ 7% 0603 ≥ 0.33μF | 25V | ≤ 3.5% | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 12.5% 0402 ≥ 0.47μF | ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF | 16V | ≤ 3.5% | ≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF | ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF | 10V | ≤ 5% | ≤ 15% 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 | -- -- | 4V | ≤ 15% | -- -- | -- -- | -- -- |
| Rated vol. | D.F. ≤                                   | Exception of D.F. ≤  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| ≥ 100V     | ≤ 2.5%                                   | ≤ 3% 1206 ≥ 0.47μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 50V        | ≤ 2.5%                                   | ≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 35V        | ≤ 3.5%                                   | ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 7% 0603 ≥ 0.33μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 25V        | ≤ 3.5%                                   | ≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 12.5% 0402 ≥ 0.47μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 16V        | ≤ 3.5%                                   | ≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 10V        | ≤ 5%                                     | ≤ 15% 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   |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | -- --  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 4V         | ≤ 15%                                    | -- --  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | -- --  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
|            |  | -- --  |   |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |
| 20         | <b>Beam Load Test</b><br>AEC-Q200-003    | * Break strength test<br>* Beam speed: 2.5±0.25 mm/sec   | The chip endure following force<br>* Chip length ≤2.5mm: Thickness >0.5mm (20N), ≤0.5mm (8N)<br>* Chip length ≥3.2mm: Thickness ≥1.25mm (54.5N), <1.25mm (15N)  |            |        |                     |        |        |                    |   |                                   |     |        |  |                                  |  |     |        |   |   |                    |     |        |  |                       |  |     |        |   |   |                                |     |      |  |                    |       |      |       |  |                    |       |    |       |       |       |       |

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



Multilayer Ceramic Capacitors

**APPENDICES**

■ Tape & reel dimensions

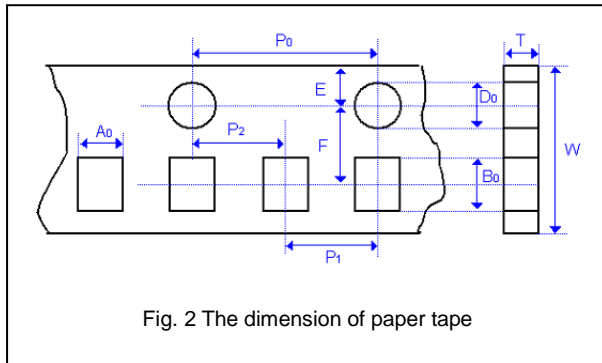


Fig. 2 The dimension of paper tape

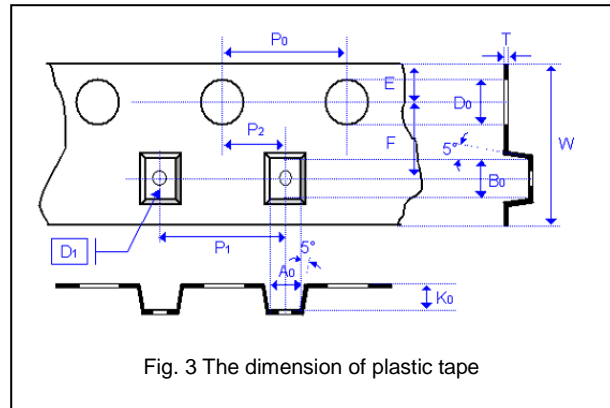


Fig. 3 The dimension of plastic tape

| Size              | 0201             | 0402             | 0603             | 0805             |                  |                  | 1206             |                  |                  | 1210             |                  |                  |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 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                |
| 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           | < 3.20           |
| 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           | < 4.00           |
| 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   |
| K <sub>0</sub>    | -                | -                | -                | -                | -                | < 2.50           | -                | < 2.50           | < 2.50           | < 1.50           | < 2.50           | < 3.20           |
| W                 | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  |
| P <sub>0</sub>    | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  |
| 10xP <sub>0</sub> | 40.00<br>+/-0.10 | 40.00<br>+/-0.10 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 |
| 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<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  |
| P <sub>2</sub>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  |
| D <sub>0</sub>    | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  |
| 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  |
| E                 | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  |
| F                 | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  |

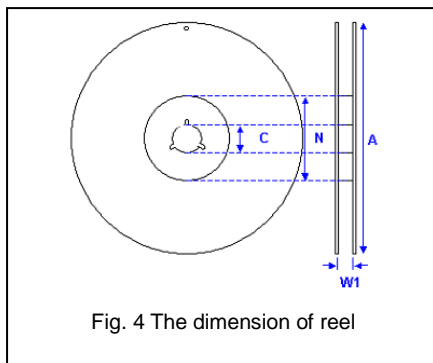
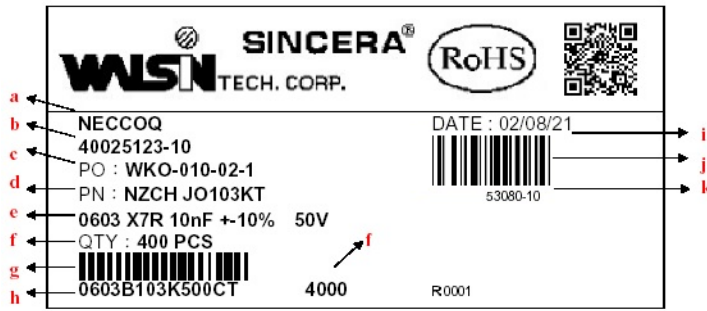


Fig. 4 The dimension of reel

| Size           | 0201, 0402, 0603, 0805, 1206, 1210 |           |           |
|----------------|------------------------------------|-----------|-----------|
| Reel size      | 7"                                 | 10"       | 13"       |
| C              | 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  |
| A              | 178.0±2.0                          | 250.0±2.0 | 330.0±2.0 |
| N              | 60.0+1.0/-0                        | 50 min    | 50 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                      |
|-----|------------------|--------------------------|--------------------------|
| 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 (Matt)                |

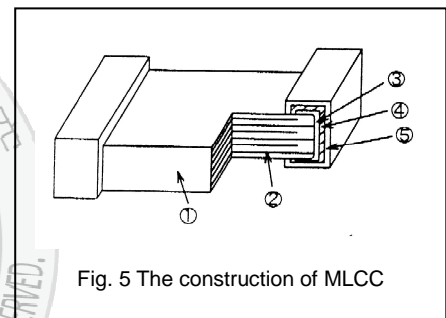


Fig. 5 The construction of MLCC

**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.

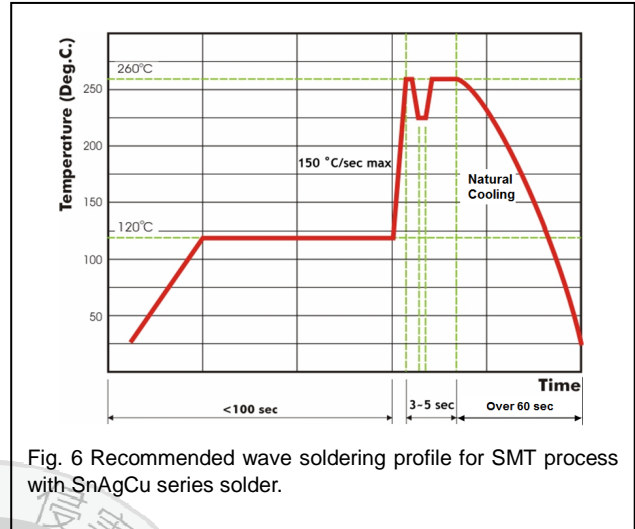
Cautions:

- 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.



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