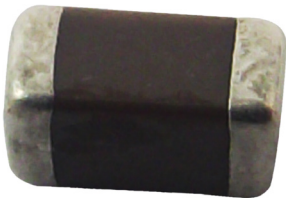


**RoHS  
Compliant**



**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 high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

**Features:**

- Small size with high capacitance.
- Capacitor with lead-free termination (pure Tin).

**Applications:**

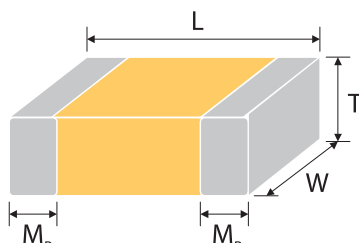
- Digital circuit coupling or decoupling applications.
- For high frequency and high-density type power suppliers.
- For bypassing.

**How To Order:**

| MC        | U  | 0805  | C                             | 102   | J   | C  | T                               |
|-----------|--|---|-------------------------------|---|---|--|---------------------------------|
|           | <u>Rated voltage</u>   | <u>Size</u>   | <u>Dielectric</u>             | <u>Capacitance</u>  | <u>Tolerance</u>  | <u>Termination</u>                                   | <u>Packaging style</u>          |
| Multicomp | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br>K = 6.3V<br>N = 10V<br>B = 16V<br>T = 25V<br>U = 50V<br>A = 100V | Inch (mm)<br>0402 (1005)<br>0603 (1608)<br>0805 (2012)<br>1206 (3216)<br>1210 (3225)<br>1812 (4532) | C=NP0 (C0G)<br>R=X7R<br>F=Y5V | 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 = $10 \times 10^2 = 1,000\text{pF}$ | B = $\pm 0.1\text{pF}$<br>C = $\pm 0.25\text{pF}$<br>O = $\pm 0.5\text{pF}$<br>F = $\pm 1\%$<br>G = $\pm 2\%$<br>J = $\pm 5\%$<br>K = $\pm 10\%$<br>M = $\pm 20\%$<br>Z = $-20/+80\%$ | C = Cu/Ni/Sn<br>L = Ag/Ni/Sn (for partial NPO items) | T = 7" reeled<br>G = 13" reeled |

Partial NP0 items are with Ag/Ni/Sn terminations, please ref to below product range of NP0 dielectric for detail.

**External Dimensions:**



The outline of MLCC

| Size Inch (mm) | L (mm)               | W (mm)                 | T (mm)/Symbol          | Remark | M <sub>B</sub> (mm) |                    |
|----------------|----------------------|------------------------|------------------------|--------|---------------------|--------------------|
| 0402 (1005)    | 1 ±0.05              | 0.5 ±0.05              | 0.5 ±0.05              | N      | #                   | 0.25<br>+0.05/-0.1 |
|                | 1 ±0.2               | 0.5 ±0.2               | 0.5 ±0.2               | E      |                     |                    |
| 0603 (1608)    | 1.6 ±0.1             | 0.8 ±0.1               | 0.8 ±0.07              | S      | #                   | 0.4±0.15           |
|                | 1.6 +0.15/-0.1       | 0.8 +0.15/-0.1         | 0.8 +0.15/-0.1         | X      |                     |                    |
| 0805 (2012)    | 2 ±0.2 <sup>*1</sup> | 0.8 ±0.2 <sup>*1</sup> | 0.8 ±0.2 <sup>*1</sup> |        | #                   | 0.5 ±0.2           |
|                | 2 ±0.15              | 1.25 ±0.1              | 0.8 ±0.1               | B      |                     |                    |
|                | 2 ±0.2               | 1.25 ±0.2              | 1.25 ±0.1              | D      |                     |                    |
|                |                      |                        | 1.25 ±0.2              | I      | #                   |                    |

**General Purpose Multilayer SMD Ceramic Capacitor**  
**0402 to 1812 Sizes, X7R, X5R, X6S & Y5V Dielectrics**



| Size<br>Inch (mm) | L (mm)       | W (mm)       | T (mm)/Symbol |   | Remark | M <sub>B</sub> (mm) |
|-------------------|--------------|--------------|---------------|---|--------|---------------------|
| 1206 (3216)       | 3.2±0.15     | 1.6±0.15     | 0.95±0.1      | C | #      | 0.6±0.2             |
|                   |              |              | 1.25±0.1      | D | #      |                     |
|                   | 3.2±0.2      | 1.6±0.2      | 1.15±0.15     | J | #      |                     |
|                   |              |              | 1.6±0.20      | G | #      |                     |
| 3.2+0.3/-0.1      | 1.6+0.3/-0.1 | 1.6+0.3/-0.1 | P             | # |        |                     |
| 1210 (3225)       | 3.2±0.3      | 2.5±0.2      | 0.95±0.1      | C | #      | 0.75±0.25           |
|                   |              |              | 1.25±0.1      | D | #      |                     |
|                   | 3.2±0.4      | 2.5±0.3      | 1.6±0.2       | G | #      |                     |
|                   |              |              | 2±0.2         | K | #      |                     |
|                   |              | 2.5±0.3      | M             | # |        |                     |
| 1812 (4532)       | 4.5±0.4      | 3.2±0.3      | 1.25±0.1      | D | #      | 0.75±0.25           |
|                   |              |              | 2±0.2         | K | #      |                     |
|                   | 4.5±0.4      | 3.2±0.4      | 2.5±0.3       | M | #      |                     |
|                   |              |              | 2.8±0.3       | U | #      |                     |

# Reflow soldering only is recommended.

\*1 : For 0603/Cap≥10μF products

**General Electrical Data:**

| Dielectric                 | X7R                                | X5R              | X6S             | Y5V          |
|----------------------------|------------------------------------|------------------|-----------------|--------------|
| Size                       | 0402, 0603, 0805, 1206, 1210, 1812 |                  |                 |              |
| Capacitance range*         | 0.56μF to 47μF                     | 0.027μF to 100μF | 0.47μF to 100μF | 1μF to 100μF |
| Capacitance tolerance**    | K (±10%), M (±20%)                 |                  |                 | Z (-20/+80%) |
| Rated voltage (WVDC)       | 6.3V, 10V, 16V, 25V, 50V, 100V     |                  |                 |              |
| DF(Tan δ)*                 | Note 1                             |                  |                 |              |
| Operating temperature      | -55 to +125°C                      | -55 to +85°C     | -55 to +105°C   | -25 to +85°C |
| Capacitance characteristic | ±15%                               |                  | ±22%            | +30/-80%     |
| Termination                | Ni/Sn (lead-free termination)      |                  |                 |              |

\* Measured at 1±0.2Vrms, 1kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature for X7R, X5R and at 20°C for Y5V.

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



**Note 1:**

X7R/X5R/X6S

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

Y5V

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

**Packaging Dimension And Quantity:**

| Size        | Thickness (mm)/Symbol |   | Paper tape |          | Plastic tape |          |
|-------------|-----------------------|---|------------|----------|--------------|----------|
|             |                       |   | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0402 (1005) | 0.50±0.05             | N | 10k        | 50k      | -            | -        |
|             | 0.50±0.20             | E | 10k        | -        | -            | -        |
| 0603 (1608) | 0.80±0.07             | S | 4k         | 15k      | -            | -        |
|             | 0.80±0.20             | X | 4k         | 15k      | -            | -        |
| 0805 (2012) | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
| 1206 (3216) | 1.25±0.20             | I | -          | -        | 3k           | 10k      |
|             | 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      |
| 1210 (3225) | 1.60+0.30/-0.10       | P | -          | -        | 2k           | 9k       |
|             | 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       |
| 1812 (4532) | 2.50±0.30             | M | -          | -        | 1k           | 6k       |
|             | 1.25±0.10             | D | -          | -        | 1k           | 5k       |
|             | 2.00±0.20             | K | -          | -        | 1k           | -        |
|             | 2.50±0.30             | M | -          | -        | 0.5k         | 3k       |
|             | 2.80±0.30             | U | -          | -        | 0.5k         | -        |

Unit : pieces

| No | Item                  | Test Condition | Requirements  |
|----|-----------------------|----------------|---|
| 1  | Visual and Mechanical | -              | No remarkable defect.<br>Dimensions to conform to individual specification sheet. |

| No               | Item                               | Test Condition  | Requirements  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|------------------|------------------------------------|---|---|------------|-------|---------------------|--|-------|-------|-----|-------------|-----|--------------------------|------|-------|-----|---|-----|------------|------|--|-----|-------|------|---------------------------------|-----|-------|-----|---------------------------------|-----|-------------------------|------|---|--------|----------|-----|-------|-----|---|------|---|-----|-----|------|---|------|----------------------|------|------|------|--|------|------------|----|------|---|---|------------|-------|---------------------|--|------|----|----|-------------------------------------|-----|----|---|---|-----|----|----|--|----|---|----------------|----|----|---------------------------|-------|-------------|------------------|----|-------|--|-----|-------|-----|-------------|------|-----|---|---|
| 2                | Capacitance                        |   | *Shall not exceed the limits given in the detailed spec.  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | <p>Class I: NP0<br/>                     Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%<br/>                     Cap&gt;1000pF 1.0±0.2Vrms, 1KHz±10%<br/>                     Class II: X7R, X5R, X6S, Y5V<br/>                     Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% **<br/>                     Cap&gt;10μF, 0.5±0.2Vrms, 120Hz±20%</p> <p>** Test condition: 0.5±0.2Vrms,<br/>                     1KHz±10%<br/>                     X7R: 0603≥225(10V),<br/>                     0805=106(6.3V&amp;10V)<br/>                     X5R: 01R5≥103, 0201≥224<br/>                     (6.3V,10V),<br/>                     0402≥475 (6.3V), 0402≥225(10V),<br/>                     0603=106 (6.3V,10V),<br/>                     TT18X ≥475(10V) , TT15X series<br/>                     X6S:0201≥224 (6.3V),0402≥225<br/>                     (6.3V),</p> | <p>NP0: Cap≥30pF, Q≥1000; Cap&lt;30pF,Q≥400+20C<br/>                     X7R,X5R,X6S:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤2.5%</td> <td>≤3%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0805&gt;0.1μF, 0603≥0.068μF</td> </tr> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤2.5%</td> <td>≤3%</td> <td>0201(50V); 0603≥0.047μF;<br/>0805≥0.18μF;1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.1μF; 0603≥1μF;<br/>0805≥1μF;1206≥4.7μF; 1210≥10μF<br/>TT series</td> </tr> <tr> <td>35V</td> <td>≤3.5%</td> <td>≤10%</td> <td>0603≥1μF; 0805≥2.2μF; 1210≥10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF; 1206≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.10μF;0603≥0.47μF;0805≥2.2<br/>μF; 1206≥6.8μF ; 1210≥22μF; TT series</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥1μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF; 0402≥0.033μF;<br/>0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF; 0402≥0.47μF;<br/>0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF;<br/>1210≥22μF; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0201≥0.012μF 0402≥0.33μF;<br/>0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF;<br/>1210≥22μF; TT series</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;<br/>0805≥4.7μF;1206≥47μF ;1210≥100μF;<br/>TT series</td> </tr> <tr> <td>≤20%</td> <td>0402≥2.2μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>Y5V:</p> <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>≥50V</td> <td>5%</td> <td>7%</td> <td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td> </tr> <tr> <td>35V</td> <td>7%</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5%</td> <td>7%</td> <td>0402≥0.047μF;0603≥0.1μF;<br/>0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>9%</td> <td>0402≥0.068μF; 0603≥0.47μF;<br/>1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">16V<br/>(C&lt;1μF)</td> <td rowspan="2">7%</td> <td>9%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>12.5%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>16V<br/>(C≥1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;<br/>1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> | Rated vol. | D.F.≤ | Exception of D.F. ≤ |  | ≥100V | ≤2.5% | ≤3% | 1206≥0.47μF | ≤5% | 0805>0.1μF, 0603≥0.068μF | ≥50V | ≤2.5% | ≤3% | 0201(50V); 0603≥0.047μF;<br>0805≥0.18μF;1206≥0.47μF | ≤5% | 1210≥4.7μF | ≤10% | 0402≥0.1μF; 0603≥1μF;<br>0805≥1μF;1206≥4.7μF; 1210≥10μF<br>TT series | 35V | ≤3.5% | ≤10% | 0603≥1μF; 0805≥2.2μF; 1210≥10μF | 25V | ≤3.5% | ≤5% | 0201≥0.01μF;0805≥1μF; 1210≥10μF | ≤7% | 0603≥0.33μF; 1206≥4.7μF | ≤10% | 0402≥0.10μF;0603≥0.47μF;0805≥2.2<br>μF; 1206≥6.8μF ; 1210≥22μF; TT series | ≤12.5% | 0402≥1μF | 16V | ≤3.5% | ≤5% | 0201≥0.01μF; 0402≥0.033μF;<br>0805≥0.68μF;1206≥2.2μF;1210≥4.7μF | ≤10% | 0201≥0.1μF; 0402≥0.47μF;<br>0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF;<br>1210≥22μF; TT series | 10V | ≤5% | ≤10% | 0201≥0.012μF 0402≥0.33μF;<br>0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF;<br>1210≥22μF; TT series | ≤15% | 0201≥0.1μF; 0402≥1μF | 6.3V | ≤10% | ≤15% | 0201≥0.1μF;0402≥1μF;0603≥10μF;<br>0805≥4.7μF;1206≥47μF ;1210≥100μF;<br>TT series | ≤20% | 0402≥2.2μF | 4V | ≤15% | - | - | Rated vol. | D.F.≤ | Exception of D.F. ≤ |  | ≥50V | 5% | 7% | 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF | 35V | 7% | - | - | 25V | 5% | 7% | 0402≥0.047μF;0603≥0.1μF;<br>0805≥0.33μF;1206≥1μF; 1210≥4.7μF | 9% | 0402≥0.068μF; 0603≥0.47μF;<br>1206≥4.7μF; 1210≥22μF | 16V<br>(C<1μF) | 7% | 9% | 0402≥0.068μF; 0603≥0.68μF | 12.5% | 0402≥0.22μF | 16V<br>(C≥1.0μF) | 9% | 12.5% | 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;<br>1210≥22μF; 1812≥47μF | 10V | 12.5% | 20% | 0402≥0.47μF | 6.3V | 20% | - | - |
| Rated vol.       | D.F.≤                              | Exception of D.F. ≤   |   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| ≥100V            | ≤2.5%                              | ≤3%   | 1206≥0.47μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤5%   | 0805>0.1μF, 0603≥0.068μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| ≥50V             | ≤2.5%                              | ≤3%   | 0201(50V); 0603≥0.047μF;<br>0805≥0.18μF;1206≥0.47μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤5%   | 1210≥4.7μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤10%  | 0402≥0.1μF; 0603≥1μF;<br>0805≥1μF;1206≥4.7μF; 1210≥10μF<br>TT series  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 35V              | ≤3.5%                              | ≤10%  | 0603≥1μF; 0805≥2.2μF; 1210≥10μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 25V              | ≤3.5%                              | ≤5%   | 0201≥0.01μF;0805≥1μF; 1210≥10μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤7%   | 0603≥0.33μF; 1206≥4.7μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤10%  | 0402≥0.10μF;0603≥0.47μF;0805≥2.2<br>μF; 1206≥6.8μF ; 1210≥22μF; TT series   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤12.5%  | 0402≥1μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 16V              | ≤3.5%                              | ≤5%   | 0201≥0.01μF; 0402≥0.033μF;<br>0805≥0.68μF;1206≥2.2μF;1210≥4.7μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤10%  | 0201≥0.1μF; 0402≥0.47μF;<br>0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF;<br>1210≥22μF; TT series   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 10V              | ≤5%                                | ≤10%  | 0201≥0.012μF 0402≥0.33μF;<br>0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF;<br>1210≥22μF; TT series   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤15%  | 0201≥0.1μF; 0402≥1μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 6.3V             | ≤10%                               | ≤15%  | 0201≥0.1μF;0402≥1μF;0603≥10μF;<br>0805≥4.7μF;1206≥47μF ;1210≥100μF;<br>TT series  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | ≤20%  | 0402≥2.2μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 4V               | ≤15%                               | -   | -   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| Rated vol.       | D.F.≤                              | Exception of D.F. ≤   |   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| ≥50V             | 5%                                 | 7%  | 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 35V              | 7%                                 | -   | -   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 25V              | 5%                                 | 7%  | 0402≥0.047μF;0603≥0.1μF;<br>0805≥0.33μF;1206≥1μF; 1210≥4.7μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | 9%  | 0402≥0.068μF; 0603≥0.47μF;<br>1206≥4.7μF; 1210≥22μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 16V<br>(C<1μF)   | 7%                                 | 9%  | 0402≥0.068μF; 0603≥0.68μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  |                                    | 12.5%   | 0402≥0.22μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 16V<br>(C≥1.0μF) | 9%                                 | 12.5%   | 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;<br>1210≥22μF; 1812≥47μF  |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 10V              | 12.5%                              | 20%   | 0402≥0.47μF   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
| 6.3V             | 20%                                | -   | -   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |
|                  | Q/ D.F.<br>(Dissipation<br>Factor) |   |   |            |       |                     |  |       |       |     |             |     |                          |      |       |     |   |     |            |      |  |     |       |      |                                 |     |       |     |                                 |     |                         |      |   |        |          |     |       |     |   |      |   |     |     |      |   |      |                      |      |      |      |  |      |            |    |      |   |   |            |       |                     |  |      |    |    |                                     |     |    |   |   |     |    |    |  |    |   |                |    |    |                           |       |             |                  |    |       |  |     |       |     |             |      |     |   |   |

| No   | Item   | Test Condition   | Requirements  |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
|--|--|--|---|---------------|-----------------------|-----------|---|--|---|--|---|--|-------------------|---------------------------|--|------------------------|-------------------------|--|-------------------|-----|-------------------|-----|-------------------|-----|-------------------|-----|------------------|
| 4  | Dielectric Strength  | To apply voltage ( $\leq 100V$ ) 250%.<br>Duration: 1 to 5 sec.<br>Charge and discharge current less than 50mA.  | No evidence of damage or flash over during test.  |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 5  | Insulation Resistance  | To apply rated voltage for max. 120 sec.   | <p>10G<math>\Omega</math> or <math>RxC \geq 500\Omega \cdot F</math> whichever is smaller.<br/>Class II (X7R, X5R, X6S, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7">10G or <math>RxC \geq 100\Omega F</math> whichever is smaller.</td> </tr> <tr> <td>50V:0603<math>\geq 1\mu F</math>;0805<math>\geq 1\mu F</math>;1206<math>\geq 4.7\mu F</math>;<br/>1210<math>\geq 4.7\mu F</math></td> </tr> <tr> <td>35V:0805<math>\geq 2.2\mu F</math>;1210<math>\geq 10\mu F</math></td> </tr> <tr> <td>25V:0402<math>\geq 1\mu F</math>;0603<math>\geq 2.2\mu F</math>;0805<math>\geq 2.2\mu F</math>;<br/>1206<math>\geq 10\mu F</math>;1210<math>\geq 10\mu F</math></td> </tr> <tr> <td>16V:0402<math>\geq 0.22\mu F</math>;0603<math>\geq 1\mu F</math>;0805<math>\geq 2.2\mu F</math>;<br/>1206<math>\geq 10\mu F</math>;1210<math>\geq 47\mu F</math></td> </tr> <tr> <td>10V:0201<math>\geq 47nF</math>;0402<math>\geq 0.47\mu F</math>;0603<math>\geq 0.47\mu F</math>;<br/>0805<math>\geq 2.2\mu F</math>; 1206<math>\geq 4.7\mu F</math>;1210<math>\geq 47\mu F</math></td> </tr> <tr> <td>6.3V ; 4V</td> </tr> <tr> <td>50V: 0402<math>\geq 0.1\mu F</math></td> <td rowspan="4">10G<math>\Omega</math> or <math>RxC \geq 50 \Omega \cdot F</math> whichever is smaller.</td> </tr> <tr> <td>35V:0603<math>\geq 1\mu F</math></td> </tr> <tr> <td>10V:0603<math>\geq 10\mu F</math></td> </tr> <tr> <td>4V:0603<math>\geq 22\mu F</math>; 0805<math>\geq 47\mu F</math></td> </tr> </tbody> </table> | Rated voltage | Insulation Resistance | 100V: X7R | 10G or $RxC \geq 100\Omega F$ whichever is smaller. | 50V:0603 $\geq 1\mu F$ ;0805 $\geq 1\mu F$ ;1206 $\geq 4.7\mu F$ ;<br>1210 $\geq 4.7\mu F$ | 35V:0805 $\geq 2.2\mu F$ ;1210 $\geq 10\mu F$ | 25V:0402 $\geq 1\mu F$ ;0603 $\geq 2.2\mu F$ ;0805 $\geq 2.2\mu F$ ;<br>1206 $\geq 10\mu F$ ;1210 $\geq 10\mu F$ | 16V:0402 $\geq 0.22\mu F$ ;0603 $\geq 1\mu F$ ;0805 $\geq 2.2\mu F$ ;<br>1206 $\geq 10\mu F$ ;1210 $\geq 47\mu F$ | 10V:0201 $\geq 47nF$ ;0402 $\geq 0.47\mu F$ ;0603 $\geq 0.47\mu F$ ;<br>0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ;1210 $\geq 47\mu F$ | 6.3V ; 4V         | 50V: 0402 $\geq 0.1\mu F$ | 10G $\Omega$ or $RxC \geq 50 \Omega \cdot F$ whichever is smaller. | 35V:0603 $\geq 1\mu F$ | 10V:0603 $\geq 10\mu F$ | 4V:0603 $\geq 22\mu F$ ; 0805 $\geq 47\mu F$ |                   |     |                   |     |                   |     |                   |     |                  |
| Rated voltage  | Insulation Resistance  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 100V: X7R  | 10G or $RxC \geq 100\Omega F$ whichever is smaller.                |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 50V:0603 $\geq 1\mu F$ ;0805 $\geq 1\mu F$ ;1206 $\geq 4.7\mu F$ ;<br>1210 $\geq 4.7\mu F$   |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 35V:0805 $\geq 2.2\mu F$ ;1210 $\geq 10\mu F$  |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 25V:0402 $\geq 1\mu F$ ;0603 $\geq 2.2\mu F$ ;0805 $\geq 2.2\mu F$ ;<br>1206 $\geq 10\mu F$ ;1210 $\geq 10\mu F$                         |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 16V:0402 $\geq 0.22\mu F$ ;0603 $\geq 1\mu F$ ;0805 $\geq 2.2\mu F$ ;<br>1206 $\geq 10\mu F$ ;1210 $\geq 47\mu F$                        |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 10V:0201 $\geq 47nF$ ;0402 $\geq 0.47\mu F$ ;0603 $\geq 0.47\mu F$ ;<br>0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ;1210 $\geq 47\mu F$ |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 6.3V ; 4V  |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 50V: 0402 $\geq 0.1\mu F$  | 10G $\Omega$ or $RxC \geq 50 \Omega \cdot F$ whichever is smaller. |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 35V:0603 $\geq 1\mu F$   |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 10V:0603 $\geq 10\mu F$  |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 4V:0603 $\geq 22\mu F$ ; 0805 $\geq 47\mu F$   |  |  |   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 6  | Temperature Coefficient  | With no electrical load.   | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> <td>NPO</td> <td>Within <math>\pm 30\text{ppm}/^\circ\text{C}</math></td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> <td>X7R</td> <td>Within <math>\pm 15\%</math></td> </tr> <tr> <td>X5R</td> <td>-55~ 85°C at 25°C</td> <td>X5R</td> <td>Within <math>\pm 15\%</math></td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> <td>X6S</td> <td>Within <math>\pm 22\%</math></td> </tr> <tr> <td>Y5V</td> <td>-25~ 85°C at 20°C</td> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table>   | T.C.          | Operating Temp        | T.C.      | Capacitance Change                                  | NPO  | -55~125°C at 25°C                             | NPO  | Within $\pm 30\text{ppm}/^\circ\text{C}$  | X7R  | -55~125°C at 25°C | X7R                       | Within $\pm 15\%$  | X5R                    | -55~ 85°C at 25°C       | X5R  | Within $\pm 15\%$ | X6S | -55~105°C at 25°C | X6S | Within $\pm 22\%$ | Y5V | -25~ 85°C at 20°C | Y5V | Within +30%/-80% |
| T.C.   | Operating Temp   | T.C.   | Capacitance Change  |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| NPO  | -55~125°C at 25°C  | NPO  | Within $\pm 30\text{ppm}/^\circ\text{C}$  |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| X7R  | -55~125°C at 25°C  | X7R  | Within $\pm 15\%$   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| X5R  | -55~ 85°C at 25°C  | X5R  | Within $\pm 15\%$   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| X6S  | -55~105°C at 25°C  | X6S  | Within $\pm 22\%$   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| Y5V  | -25~ 85°C at 20°C  | Y5V  | Within +30%/-80%  |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 7  | Adhesive Strength of Termination                                   | Pressurizing force:<br>5N ( $\leq 0603$ ) and 10N ( $>0603$ )<br>* Test time: 10 $\pm$ 1 sec.  | No remarkable damage or removal of the terminations.  |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |
| 8  | Vibration Resistance   | Vibration frequency: 10~55 Hz/min.<br>Total amplitude: 1.5mm<br>Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)<br>Measurement to be made after keeping at room temp. for 24 $\pm$ 2 hrs. | No remarkable damage.<br>Cap change and Q/D.F.: To meet initial spec.   |               |                       |           |   |  |   |  |   |  |                   |                           |  |                        |                         |  |                   |     |                   |     |                   |     |                   |     |                  |

| No   | Item                         | Test Condition   | Requirements  |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
|------|------------------------------|--|---|------------|-------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|---|
| 9    | Solderability                | Solder temperature: 235±5°C<br>Dipping time: 2±0.5 sec.  | 95% min. coverage of all metalized area.  |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 10.  | Bending Test                 | The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec. Measurement to be made after keeping at room temp. for 24±2 hrs.  | No remarkable damage.<br>Cap change:<br>NP0: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S: within ±12.5%<br>Y5V: within ±30%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 11   | Resistance to Soldering Heat | Solder temperature: 260±5°C<br>Dipping time: 10±1 sec<br>Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.<br>Before initial measurement (Class II only): 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:<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S: within ±7.5%<br>Y5V: within ±20%<br>Q/D.F., I.R. and dielectric strength: To meet initial requirements.<br>25% max. leaching on each edge.                                      |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 12   | Temperature Cycle            | Conduct the five cycles according to the temperatures and time.<br><table border="1" data-bbox="359 1220 790 1422"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table><br>Before initial measurement (Class II 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. | Step  | Temp. (°C) | Time (min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | No remarkable damage.<br>Cap change:<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S: within ±7.5%<br>Y5V: within ±20%<br>Q/D.F., I.R. and dielectric strength: To meet initial requirements. |
| Step | Temp. (°C)                   | Time (min.)  |   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 1    | Min. operating temp. +0/-3   | 30±3   |   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 2    | Room temp.                   | 2~3  |   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 3    | Max. operating temp. +3/-0   | 30±3   |   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 4    | Room temp.                   | 2~3  |   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |   |

| No   | Item                                    | Test Condition  | Requirements  |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|------|---|---|---|------------|---------------------|--|--|-------|-----|-----|-------------|-------|--------------------------|------|-----|-----|---|------|------------|------|---|-----|-----|------|---------------------------------|-----|-----|------|----------------------------------|------|-------------------------|------|--|------|----------|-----|-----|------|--|------|--|-----|-------|------|--|------|--------------------------------|------|------|------|---|----|------|---|---|
| 13   | Humidity<br>(Damp Heat)<br>Steady State | Test temp.: 40±2°C<br>Humidity: 90~95% RH<br>Test time: 500+24/-0hrs.<br>Before initial measurement (Class II 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:<br>NP0: within ±5% or 0.5pF whichever is larger<br>X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br>TT series & C ≥ 1uF, within ±25%<br>**10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%;<br>Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%<br>Q/D.F. value:<br>NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C<br>Less than 10pF Q≥200+10C<br>X7R, X5R, X6S:  |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
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|      |   |   | Rated vol.  | D.F.≤      | Exception of D.F. ≤ |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   | ≥100V   | ≤3%        | ≤6%                 | 1206≥0.47μF  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   |   |            | ≤7.5%               | 0805>0.1μF, 0603≥0.068μF   |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   | ≥50V  | ≤3%        | ≤6%                 | 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF                      |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   |   |            | ≤10%                | 1210≥4.7μF   |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   |   |            | ≤20%                | 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥10μF TT series        |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   | 35V   | ≤5%        | ≤20%                | 0603≥1μF; 0805≥2.2μF; 1210≥10μF  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   | 25V   | ≤5%        | ≤10%                | 0201≥0.01μF; 0805≥1μF; 1210≥10μF                                       |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   |   |            | ≤14%                | 0603≥0.33μF; 1206≥4.7μF  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   |   |            | ≤15%                | 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   |   |   |            | ≤20%                | 0402≥1μF   |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
| 16V  | ≤5%                                     | ≤10%  | 0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF  |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   | ≤15%  | 0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series  |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
| 10V  | ≤7.5%                                   | ≤15%  | 0201≥0.012μF 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF  |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
|      |   | ≤20%  | 0201≥0.1μF; 0402≥1μF TT series  |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
| 6.3V | ≤15%                                    | ≤30%  | 0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series   |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |
| 4V   | ≤20%                                    | -   | -   |            |                     |  |  |       |     |     |             |       |                          |      |     |     |   |      |            |      |   |     |     |      |                                 |     |     |      |                                  |      |                         |      |  |      |          |     |     |      |  |      |  |     |       |      |  |      |                                |      |      |      |   |    |      |   |   |



| No   | Item   | Test Condition  | Requirements   |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
|--|--|---|--|------------|--------|---------------------|--|------|------|-----|-------------------------------------|-----|-----|---|---|-----|------|-----|---|-----|--|----------------|-----|-------|---------------------------|-----|-------------|------------------|-------|-----|---|-----|-----|-----|-------------|------|-----|---|---|---------------|-----------------------|-----------|--|---|--------------------------------------|---|--|---|-----------------------|-----------|
| 13   |  |   | <p>Y5V:</p> <table border="1" data-bbox="807 472 1445 916"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>7.5%</td> <td>10%</td> <td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>15%</td> <td>0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">16V<br/>(C&lt;1μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>16V<br/>(C≥1.0μF)</td> <td>12.5%</td> <td>20%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.<br/>                     Class II (X7R, X5R, X6S, Y5V)</p> <table border="1" data-bbox="807 999 1445 1458"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="8">1GΩ or<br/>RxC≥10 Ω-F<br/>whichever is<br/>smaller.</td> </tr> <tr> <td>50V: 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF; 0805≥2.2μF; 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF</td> </tr> <tr> <td>16V: 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;</td> </tr> <tr> <td>1206≥4.7μF; 1210≥47μF</td> </tr> <tr> <td>6.3V ; 4V</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥50V | 7.5% | 10% | 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF | 35V | 10% | - | - | 25V | 7.5% | 10% | 0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF | 15% | 0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF | 16V<br>(C<1μF) | 10% | 12.5% | 0402≥0.068μF; 0603≥0.68μF | 20% | 0402≥0.22μF | 16V<br>(C≥1.0μF) | 12.5% | 20% | 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF | 10V | 20% | 30% | 0402≥0.47μF | 6.3V | 30% | - | - | Rated voltage | Insulation Resistance | 100V: X7R | 1GΩ or<br>RxC≥10 Ω-F<br>whichever is<br>smaller. | 50V: 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF | 35V: 0603≥1μF; 0805≥2.2μF; 1210≥10μF | 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF | 16V: 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 |
| Rated vol.   | D.F. ≤   | Exception of D.F. ≤   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| ≥50V   | 7.5%   | 10%   | 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 35V  | 10%  | -   | -  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 25V  | 7.5%   | 10%   | 0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
|  |  | 15%   | 0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF   |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 16V<br>(C<1μF)   | 10%  | 12.5%   | 0402≥0.068μF; 0603≥0.68μF  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
|  |  | 20%   | 0402≥0.22μF  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 16V<br>(C≥1.0μF)   | 12.5%  | 20%   | 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 10V  | 20%  | 30%   | 0402≥0.47μF  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 6.3V   | 30%  | -   | -  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| Rated voltage  | Insulation Resistance                            |   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 100V: X7R  | 1GΩ or<br>RxC≥10 Ω-F<br>whichever is<br>smaller. |   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 50V: 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF  |  |   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 35V: 0603≥1μF; 0805≥2.2μF; 1210≥10μF                         |  |   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF  |  |   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 16V: 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  |  |   |  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |
| 14   | Humidity (Damp Heat) Load                        | Test temp.: 40±2°C<br>Humidity: 90~95%RH<br>Test time: 500+24/-0 hrs.<br>To apply voltage : rated voltage.<br>Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.<br>Measurement to be made after keeping at room temp. for 24±2 hrs. | No remarkable damage.<br>Cap change:<br>NP0: ±7.5% or 0.75pF whichever is larger.<br>X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br>TT series & C≥ 1uF, within ±25%<br>**10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%;<br>Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%<br>Q/D.F. value:<br>NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C  |            |        |                     |  |      |      |     |                                     |     |     |   |   |     |      |     |   |     |  |                |     |       |                           |     |             |                  |       |     |   |     |     |     |             |      |     |   |   |               |                       |           |  |   |                                      |   |  |   |                       |           |

| No                 | Item  | Test Condition | Requirements   |               |                            |  |
|--------------------|---|----------------|--|---------------|----------------------------|--|
| 14                 | Humidity<br>(Damp Heat)<br>Load                             |                | X7R, X5R, X6S:   |               |                            |  |
|                    |   |                | <b>Rated vol.</b>  | <b>D.F. ≤</b> | <b>Exception of D.F. ≤</b> |  |
|                    |   |                | ≥100V  | ≤3%           | ≤6%                        | 1206 ≥ 0.47μF  |
|                    |   |                |  |               | ≤7.5%                      | 0805 > 0.1μF; 0603 ≥ 0.068μF   |
|                    |   |                | ≥50V   | ≤3%           | ≤6%                        | 0201(50V); 0603 ≥ 0.047μF;<br>0805 ≥ 0.18μF; 1206 ≥ 0.47μF   |
|                    |   |                |  |               | ≤10%                       | 1210 ≥ 4.7μF   |
|                    |   |                |  |               | ≤20%                       | 0402 ≥ 0.1μF; 0603 ≥ 1μF;<br>0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF<br>TT series                        |
|                    |   |                | 35V  | ≤5%           | ≤20%                       | 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF  |
|                    |   |                | 25V  | ≤5%           | ≤10%                       | 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF   |
|                    |   |                |  |               | ≤14%                       | 0603 ≥ 0.33μF; 1206 ≥ 4.7μF  |
|                    |   |                |  |               | ≤15%                       | 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF;<br>1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series                    |
|                    |   |                |  |               | ≤20%                       | 0402 ≥ 1μF   |
|                    |   |                | 16V  | ≤5%           | ≤10%                       | 0201 ≥ 0.01μF; 0402 ≥ 0.033μF;<br>0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF                            |
|                    |   |                |  |               | ≤15%                       | 0201 ≥ 0.1μF; 0402 ≥ 0.47μF;<br>0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF;<br>1210 ≥ 22μF; TT series   |
|                    |   |                | 10V  | ≤7.5%         | ≤15%                       | 0201 ≥ 0.012μF; 0402 ≥ 0.33μF;<br>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF;<br>1210 ≥ 22μF; TT series |
|                    |   |                |  |               | ≤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;<br>TT series        |
|                    |   |                | 4V   | ≤20%          | -                          | -  |
|                    |   |                | Y5V:   |               |                            |  |
|                    |   |                | <b>Rated vol.</b>  | <b>D.F. ≤</b> | <b>Exception of D.F. ≤</b> |  |
|                    |   |                | ≥50V   | 7.5%          | 10%                        | 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF  |
|                    |   |                | 35V  | 10%           | -                          | -  |
|                    |   |                | 25V  | 7.5%          | 10%                        | 0402 ≥ 0.047μF; 0603 ≥ 0.1μF;<br>0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF                               |
| 15%                | 0402 ≥ 0.068μF; 0603 ≥ 0.47μF;<br>1206 ≥ 4.7μF; 1210 ≥ 22μF |                |  |               |                            |  |
| 16V<br>(C < 1μF)   | 10%   | 12.5%          | 0402 ≥ 0.068μF; 0603 ≥ 0.68μF  |               |                            |  |
|                    |   | 20%            | 0402 ≥ 0.22μF  |               |                            |  |
| 16V<br>(C ≥ 1.0μF) | 12.5%   | 20%            | 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF;<br>1210 ≥ 22μF; 1812 ≥ 47μF |               |                            |  |
| 10V                | 20%   | 30%            | 0402 ≥ 0.47μF  |               |                            |  |
| 6.3V               | 30%   | -              | -  |               |                            |  |

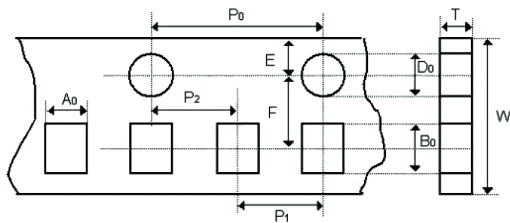
| No  | Item   | Test Condition   | Requirements  |               |                       |           |  |   |   |  |   |   |   |           |  |
|---|--|--|---|---------------|-----------------------|-----------|--|---|---|--|---|---|---|-----------|--|
| 14  | Humidity<br>(Damp Heat)<br>Load  |  | <p>*I.R.: <math>\geq 10V</math>, <math>500M\Omega</math> or <math>25 \Omega\text{-F}</math> whichever is smaller.<br/>                     Class II (X7R, X5R, X6S, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7">500G<math>\Omega</math> or<br/>RxC<math>\geq 5 \Omega\text{-F}</math><br/>whichever is<br/>smaller.</td> </tr> <tr> <td>50V: 0402<math>\geq 0.1\mu\text{F}</math>;0603<math>\geq 1\mu\text{F}</math>;0805<math>\geq 1\mu\text{F}</math>;<br/>1206<math>\geq 4.7\mu\text{F}</math>;1210<math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td>35V: 0603<math>\geq 1\mu\text{F}</math>; 0805<math>\geq 2.2\mu\text{F}</math>;1210<math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>25V:0402<math>\geq 1\mu\text{F}</math>;0603<math>\geq 2.2\mu\text{F}</math>;0805<math>\geq 2.2\mu\text{F}</math>;<br/>1206<math>\geq 10\mu\text{F}</math>;1210<math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>16V:0402<math>\geq 0.22\mu\text{F}</math>;0603<math>\geq 1\mu\text{F}</math>;0805<math>\geq 2.2\mu\text{F}</math>;<br/>1206<math>\geq 10\mu\text{F}</math>;1210<math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V:0201<math>\geq 47\text{nF}</math>;0402<math>\geq 0.47\mu\text{F}</math>;0603<math>\geq 0.47</math><br/><math>\mu\text{F}</math>;0805<math>\geq 2.2\mu\text{F}</math>;</td> </tr> <tr> <td>1206<math>\geq 4.7\mu\text{F}</math>;1210<math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>6.3V ; 4V</td> <td></td> </tr> </tbody> </table> | Rated voltage | Insulation Resistance | 100V: X7R | 500G $\Omega$ or<br>RxC $\geq 5 \Omega\text{-F}$<br>whichever is<br>smaller. | 50V: 0402 $\geq 0.1\mu\text{F}$ ;0603 $\geq 1\mu\text{F}$ ;0805 $\geq 1\mu\text{F}$ ;<br>1206 $\geq 4.7\mu\text{F}$ ;1210 $\geq 4.7\mu\text{F}$ | 35V: 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ;1210 $\geq 10\mu\text{F}$ | 25V:0402 $\geq 1\mu\text{F}$ ;0603 $\geq 2.2\mu\text{F}$ ;0805 $\geq 2.2\mu\text{F}$ ;<br>1206 $\geq 10\mu\text{F}$ ;1210 $\geq 10\mu\text{F}$ | 16V:0402 $\geq 0.22\mu\text{F}$ ;0603 $\geq 1\mu\text{F}$ ;0805 $\geq 2.2\mu\text{F}$ ;<br>1206 $\geq 10\mu\text{F}$ ;1210 $\geq 47\mu\text{F}$ | 10V:0201 $\geq 47\text{nF}$ ;0402 $\geq 0.47\mu\text{F}$ ;0603 $\geq 0.47$<br>$\mu\text{F}$ ;0805 $\geq 2.2\mu\text{F}$ ; | 1206 $\geq 4.7\mu\text{F}$ ;1210 $\geq 47\mu\text{F}$ | 6.3V ; 4V |  |
| Rated voltage   | Insulation Resistance  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 100V: X7R   | 500G $\Omega$ or<br>RxC $\geq 5 \Omega\text{-F}$<br>whichever is<br>smaller. |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 50V: 0402 $\geq 0.1\mu\text{F}$ ;0603 $\geq 1\mu\text{F}$ ;0805 $\geq 1\mu\text{F}$ ;<br>1206 $\geq 4.7\mu\text{F}$ ;1210 $\geq 4.7\mu\text{F}$ |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 35V: 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ;1210 $\geq 10\mu\text{F}$   |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 25V:0402 $\geq 1\mu\text{F}$ ;0603 $\geq 2.2\mu\text{F}$ ;0805 $\geq 2.2\mu\text{F}$ ;<br>1206 $\geq 10\mu\text{F}$ ;1210 $\geq 10\mu\text{F}$  |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 16V:0402 $\geq 0.22\mu\text{F}$ ;0603 $\geq 1\mu\text{F}$ ;0805 $\geq 2.2\mu\text{F}$ ;<br>1206 $\geq 10\mu\text{F}$ ;1210 $\geq 47\mu\text{F}$ |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 10V:0201 $\geq 47\text{nF}$ ;0402 $\geq 0.47\mu\text{F}$ ;0603 $\geq 0.47$<br>$\mu\text{F}$ ;0805 $\geq 2.2\mu\text{F}$ ;                       |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 1206 $\geq 4.7\mu\text{F}$ ;1210 $\geq 47\mu\text{F}$   |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 6.3V ; 4V   |  |  |   |               |                       |           |  |   |   |  |   |   |   |           |  |
| 15.   | High<br>Temperature<br>Load<br>(Endurance)                                   | <p>*Test temp.:<br/>                     NP0, X7R/X7E: <math>125\pm 3^{\circ}\text{C}</math><br/>                     X6S: <math>105\pm 3^{\circ}\text{C}</math><br/>                     X5R, Y5V: <math>85\pm 3^{\circ}\text{C}</math><br/>                     *Test time: 1000+24/-0 hrs.<br/>                     *To apply voltage:<br/>                     1) <math>\leq</math> % of rated voltage.<br/>                     2) <math>10V \leq U_r &lt; 500V</math>:<br/>                     200% of rated voltage.<br/>                     3) <math>500V</math>: 150% of rated voltage.<br/>                     4) <math>U_r \geq 630V</math>:<br/>                     120% of rated voltage.</p> | <p>No remarkable damage.<br/>                     Cap change:<br/>                     NP0: <math>\pm 3.0\%</math> or <math>\pm 0.3\text{pF}</math> whichever is larger<br/>                     X7R, X5R, X6S: <math>\geq 10V^{**}</math>, within <math>\pm 12.5\%</math>; <math>\leq 6.3V</math> within <math>\pm 25\%</math>;<br/>                     TT series &amp; C <math>\geq 1\mu\text{F}</math>, within <math>\pm 25\%</math><br/>                     **10V: 0603<math>\geq 4.7\mu\text{F}</math>;0402<math>\geq 1\mu\text{F}</math>;0201<math>\geq 0.1\mu\text{F}</math>, within <math>\pm 25\%</math>;<br/>                     Y5V: <math>\geq 10V</math>, within <math>\pm 30\%</math>; <math>\leq 6.3V</math>, within +30/-40%<br/>                     Q/D.F. value:<br/>                     NP0: More than 30pF, Q<math>\geq 350</math><br/>                     10pF<math>\leq C &lt; 30\text{pF}</math>, Q<math>\geq 275+2.5C</math><br/>                     Less than 10pF, Q<math>\geq 200+10C</math></p>  |               |                       |           |  |   |   |  |   |   |   |           |  |

| No   | Item                              | Test Condition  | Requirements  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|------|-----------------------------------|---|---|------------|--|--|------|-------------|-----------|---------|-------------|-------------|--------------------------|---------|------|-------------|---|--------|------------|---------|---|---------|------|-------------|---------------------------------|--------|------|--------|----------------------------------|----------|-------------------------|--------|--|-----|--------|---------|--|------|--|---------|--|-----|-------|--------|----------------------|------|------|--------|---|------------|---------------|-------------------|------|-------------|--------|---------------------|------|-------------|------|---------|-------------------------------------|----------|-----|-----|-----|----------|------|-------------|---|---------|--|-------------|---------|-------|---------------------------|--------|-------------|---------------|-------|---------|---|----------|-------------|------|-----|---------|------|-----|------|---------|--|
| 15   | High Temperature Load (Endurance) | 5) 100% of rated voltage for below range.   | <b>X7R, X5R, X6S:</b> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤3%</td> <td>≤6%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤7.5%</td> <td>0805&gt;0.1μF, 0603≥0.068μF</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>1210≥4.7μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥10μF TT series</td> </tr> <tr> <td>35V</td> <td>≤5%</td> <td>≤20%</td> <td>0603≥1μF; 0805≥2.2μF; 1210≥10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤10%</td> <td>0201≥0.01μF; 0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>≤14%</td> <td>0603≥0.33μF; 1206≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤10%</td> <td>0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.012μF; 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series</td> </tr> <tr> <td>10V</td> <td>≤7.5%</td> <td>≤15%</td> <td>0201≥0.1μF; 0402≥1μF</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30%</td> <td>0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>-</td> <td>-</td> </tr> </tbody> </table><br><b>Y5V:</b> <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>≥50V</td> <td>7.5%</td> <td>10%</td> <td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>15%</td> <td>0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">16V (C&lt;1μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">16V (C≥1.0μF)</td> <td rowspan="2">12.5%</td> <td>20%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> | Rated vol. | D.F. ≤                                     | Exception of D.F. ≤  |      | ≥100V       | ≤3%       | ≤6%     | 1206≥0.47μF | ≤7.5%       | 0805>0.1μF, 0603≥0.068μF | ≥50V    | ≤3%  | ≤6%         | 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF | ≤10%   | 1210≥4.7μF | ≤20%    | 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥10μF TT series | 35V     | ≤5%  | ≤20%        | 0603≥1μF; 0805≥2.2μF; 1210≥10μF | 25V    | ≤5%  | ≤10%   | 0201≥0.01μF; 0805≥1μF; 1210≥10μF | ≤14%     | 0603≥0.33μF; 1206≥4.7μF | ≤15%   | 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series | 16V | ≤5%    | ≤10%    | 0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF | ≤15% | 0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series | ≤20%    | 0201≥0.012μF; 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series | 10V | ≤7.5% | ≤15%   | 0201≥0.1μF; 0402≥1μF | 6.3V | ≤15% | ≤30%   | 0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series | 4V         | ≤20%          | -                 | -    | Rated vol.  | D.F. ≤ | Exception of D.F. ≤ |      | ≥50V        | 7.5% | 10%     | 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF | 35V      | 10% | -   | -   | 25V      | 7.5% | 10%         | 0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF | 15%     | 0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF | 16V (C<1μF) | 10%     | 12.5% | 0402≥0.068μF; 0603≥0.68μF | 20%    | 0402≥0.22μF | 16V (C≥1.0μF) | 12.5% | 20%     | 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF | 30%      | 0402≥0.47μF | 6.3V | 30% | -       | -    |     |      |         |  |
|      |                                   | Rated vol.  |   | D.F. ≤     | Exception of D.F. ≤                        |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | ≥100V   |   | ≤3%        | ≤6%  | 1206≥0.47μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤7.5%                                      | 0805>0.1μF, 0603≥0.068μF   |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | ≥50V  |   | ≤3%        | ≤6%  | 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF                                    |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤10%                                       | 1210≥4.7μF   |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤20%                                       | 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥10μF TT series                      |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 35V   |   | ≤5%        | ≤20%                                       | 0603≥1μF; 0805≥2.2μF; 1210≥10μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 25V   |   | ≤5%        | ≤10%                                       | 0201≥0.01μF; 0805≥1μF; 1210≥10μF   |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤14%                                       | 0603≥0.33μF; 1206≥4.7μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤15%                                       | 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series               |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 16V   |   | ≤5%        | ≤10%                                       | 0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF                       |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤15%                                       | 0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series   |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | ≤20%                                       | 0201≥0.012μF; 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 10V   |   | ≤7.5%      | ≤15%                                       | 0201≥0.1μF; 0402≥1μF   |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 6.3V  |   | ≤15%       | ≤30%                                       | 0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series        |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 4V  |   | ≤20%       | -  | -  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | Rated vol.  |   | D.F. ≤     | Exception of D.F. ≤                        |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | ≥50V  |   | 7.5%       | 10%  | 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 35V   |   | 10%        | -  | -  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 25V   |   | 7.5%       | 10%  | 0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF                          |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | 15%  | 0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF                                     |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 16V (C<1μF)   |   | 10%        | 12.5%                                      | 0402≥0.068μF; 0603≥0.68μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | 20%  | 0402≥0.22μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 16V (C≥1.0μF)   |   | 12.5%      | 20%  | 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF                              |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | 30%  | 0402≥0.47μF  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 6.3V  |   | 30%        | -  | -  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   |   |            | (6) 150% of rated voltage for below range. |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R/X7R/X6S</td> <td>6.3V, 10V</td> <td>C≥0.1μF</td> </tr> <tr> <td>0402</td> <td>X5R/X7R/X6S</td> <td>6.3V, 10V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="3">0603</td> <td rowspan="3">X5R/X7R/X6S</td> <td>4V</td> <td>C≥22μF</td> </tr> <tr> <td>6.3V, 10V</td> <td>C≥4.7μF</td> </tr> <tr> <td>35V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6S</td> <td>4V</td> <td>C≥47μF</td> </tr> <tr> <td>6.3V</td> <td>C≥22μF</td> </tr> <tr> <td>1206</td> <td>X5R/X7R/</td> <td>6.3V</td> <td>C≥47μF</td> </tr> <tr> <td></td> <td>NP0</td> <td>3,000V</td> <td>C≥1.5pF</td> </tr> <tr> <td>TT18</td> <td>Y5V</td> <td>6.3V, 10</td> <td>C≥2.2μF</td> </tr> <tr> <td>TT21</td> <td>Y5V</td> <td>6.3V</td> <td>C≥10μF</td> </tr> <tr> <td>TT31</td> <td>Y5V</td> <td>6.3V</td> <td>C≥22μF</td> </tr> </tbody> </table><br><table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R/X7R/X6S</td> <td>16V</td> <td>C≥0.1μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X6S</td> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td>10V~25V</td> <td>C≥0.22μF</td> </tr> <tr> <td></td> <td>Y5V</td> <td>16V</td> <td>C≥0.47μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6S</td> <td>10V, 50V</td> <td>C≥1.0μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C≥2.2μF</td> </tr> <tr> <td rowspan="3">0805</td> <td rowspan="3">X5R/X7R/X6S</td> <td>10~50V</td> <td>C≥4.7μF</td> </tr> <tr> <td rowspan="2">X7R</td> <td>50V</td> <td>C≥2.2μF</td> </tr> <tr> <td>100V</td> <td>C≥0.47μF</td> </tr> <tr> <td></td> <td>Y5V</td> <td>16V</td> <td>C≥4.7μF</td> </tr> <tr> <td>2220</td> <td>X7R</td> <td>100V</td> <td>C≥6.8μF</td> </tr> </tbody> </table> | Size  | Dielectric | Rated voltage                              | Capacitance range  | 0201 | X5R/X7R/X6S | 6.3V, 10V | C≥0.1μF | 0402        | X5R/X7R/X6S | 6.3V, 10V                | C≥1.0μF | 0603 | X5R/X7R/X6S | 4V  | C≥22μF | 6.3V, 10V  | C≥4.7μF | 35V   | C≥1.0μF | 0805 | X5R/X7R/X6S | 4V                              | C≥47μF | 6.3V | C≥22μF | 1206                             | X5R/X7R/ | 6.3V                    | C≥47μF |  | NP0 | 3,000V | C≥1.5pF | TT18   | Y5V  | 6.3V, 10   | C≥2.2μF | TT21   | Y5V | 6.3V  | C≥10μF | TT31                 | Y5V  | 6.3V | C≥22μF | Size  | Dielectric | Rated voltage | Capacitance range | 0201 | X5R/X7R/X6S | 16V    | C≥0.1μF             | 0402 | X5R/X7R/X6S | 50V  | C≥0.1μF | 10V~25V                             | C≥0.22μF |     | Y5V | 16V | C≥0.47μF | 0603 | X5R/X7R/X6S | 10V, 50V  | C≥1.0μF | Y5V  | 16V         | C≥2.2μF | 0805  | X5R/X7R/X6S               | 10~50V | C≥4.7μF     | X7R           | 50V   | C≥2.2μF | 100V  | C≥0.47μF |             | Y5V  | 16V | C≥4.7μF | 2220 | X7R | 100V | C≥6.8μF |  |
| Size | Dielectric                        | Rated voltage   | Capacitance range   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0201 | X5R/X7R/X6S                       | 6.3V, 10V   | C≥0.1μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0402 | X5R/X7R/X6S                       | 6.3V, 10V   | C≥1.0μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0603 | X5R/X7R/X6S                       | 4V  | C≥22μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 6.3V, 10V   | C≥4.7μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 35V   | C≥1.0μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0805 | X5R/X7R/X6S                       | 4V  | C≥47μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 6.3V  | C≥22μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 1206 | X5R/X7R/                          | 6.3V  | C≥47μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      | NP0                               | 3,000V  | C≥1.5pF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| TT18 | Y5V                               | 6.3V, 10  | C≥2.2μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| TT21 | Y5V                               | 6.3V  | C≥10μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| TT31 | Y5V                               | 6.3V  | C≥22μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| Size | Dielectric                        | Rated voltage   | Capacitance range   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0201 | X5R/X7R/X6S                       | 16V   | C≥0.1μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0402 | X5R/X7R/X6S                       | 50V   | C≥0.1μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | 10V~25V   | C≥0.22μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      | Y5V                               | 16V   | C≥0.47μF  |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0603 | X5R/X7R/X6S                       | 10V, 50V  | C≥1.0μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | Y5V   | 16V   | C≥2.2μF    |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 0805 | X5R/X7R/X6S                       | 10~50V  | C≥4.7μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   | X7R   | 50V   | C≥2.2μF    |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      |                                   |   | 100V  | C≥0.47μF   |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
|      | Y5V                               | 16V   | C≥4.7μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |
| 2220 | X7R                               | 100V  | C≥6.8μF   |            |  |  |      |             |           |         |             |             |                          |         |      |             |   |        |            |         |   |         |      |             |                                 |        |      |        |                                  |          |                         |        |  |     |        |         |  |      |  |         |  |     |       |        |                      |      |      |        |   |            |               |                   |      |             |        |                     |      |             |      |         |                                     |          |     |     |     |          |      |             |   |         |  |             |         |       |                           |        |             |               |       |         |   |          |             |      |     |         |      |     |      |         |  |

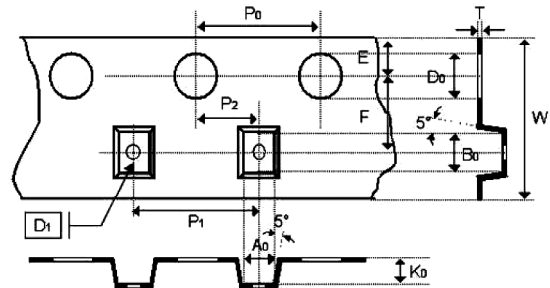
| No  | Item                              | Test Condition   | Requirements  |   |
|---|-----------------------------------|--|---|---|
| 15  | High Temperature Load (Endurance) | *Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.<br>*Measurement to be made after keeping at room temp. for 24±2 hrs | *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.<br>Class II (X7R, X5R, X6S, Y5V) |   |
|   |                                   |  | <b>Rated voltage</b>  | <b>Insulation Resistance</b>              |
|   |                                   |  | 100V: X7R   | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. |
|   |                                   |  | 50V: 0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF             |   |
|   |                                   |  | 35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF  |   |
|   |                                   |  | 25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF             |   |
|   |                                   |  | 16V: 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   |                                   |  |   |   |

## Appendixes

### Tape & Reel Dimensions

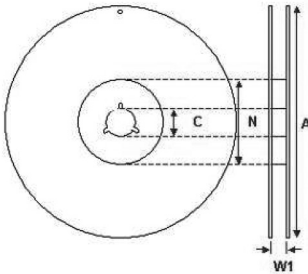


The dimension of paper tape



The dimension of plastic tape

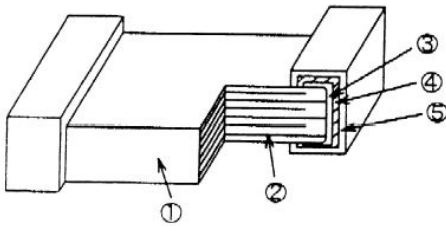
| Size              | 0402      |           | 0603      | 0805      |           |           | 1206      |           |           | 1210      |           |           | 1812      |           |           |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Thickness         | N         | E         | S, X      | A         | B         | C, D, I   | B         | C, J, D   | G, P      | C, D      | G, K      | M         | D, K      | M         | U         |
| A <sub>0</sub>    | 0.62±0.05 | 0.7±0.10  | 1.02±0.05 | 1.5±0.1   | 1.5±0.1   | <1.57     | 2±0.1     | <1.85     | <1.95     | <2.97     | <2.97     | <2.97     | <3.81     | <3.81     | <3.9      |
| B <sub>0</sub>    | 1.12±0.05 | 1.2±0.10  | 1.8±0.05  | 2.3±0.1   | 2.3±0.1   | <2.40     | 3.5±0.1   | <3.46     | <3.67     | <3.73     | <3.73     | <3.73     | <5.3      | <5.3      | <5.3      |
| T                 | 0.6±0.05  | 0.7±0.10  | 0.95±0.05 | 0.75±0.05 | 0.95±0.05 | 0.23±0.05 | 0.95±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 |
| K <sub>0</sub>    | -         | -         | -         | -         | -         | <2.5      | -         | <2.5      | <2.5      | <2.5      | <2.5      | <3        | <2.5      | <3        | <3.5      |
| W                 | 8±0.1     | 8±0.10    | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 8±0.1     | 12±0.2    | 12±0.2    | 12±0.2    |
| P <sub>0</sub>    | 4±0.1     | 4±0.10    | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     |
| 10xP <sub>0</sub> | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.1    | 40±0.2    |
| P <sub>1</sub>    | 2±0.05    | 2±0.05    | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.1     | 4±0.10    | 4±0.1     | 8±0.1     | 8±0.1     | 8±0.1     |
| P <sub>2</sub>    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    | 2±0.05    |
| D <sub>0</sub>    | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.05  | 1.5±0.1   |
| D <sub>1</sub>    | -         | -         | -         | -         | -         | 1±0.1     | -         | 1±0.1     | 1±0.1     | 1±0.1     | 1±0.1     | 1±0.1     | 1.5±0.1   | 1.5±0.1   | 1.5±0.1   |
| E                 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  | 1.75±0.1  |
| F                 | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 3.5±0.05  | 5.5±0.05  | 5.5±0.05  | 5.5±0.05  |



The dimension of reel

| Size      | 0402, 0603, 0805, 1206, 1210 |              |              | 1812         |
|-----------|------------------------------|--------------|--------------|--------------|
| Reel size | 7"                           | 10"          | 13"          | 7"           |
| C         | 13 +0.5/-0.2                 | 13 +0.5/-0.2 | 13 +0.5/-0.2 | 13 +0.5/-0.2 |
| W1        | 8.4 +1.5/-0                  | 8.4+1.5/-0   | 8.4 +1.5/-0  | 12.4+2.0/-0  |
| A         | 178 ±0.1                     | 250 ±1       | 330 ±1       | 178 ±0.1     |
| N         | 60 +1/-0                     | 100 ±1       | 100 ±1       | 60 +1/-0     |

**Constructions:**



| No. | Name             | NP0*                     | NPO, X7R, Y5V |
|-----|------------------|--------------------------|---------------|
| 1   | Ceramic material | BaTiO <sub>3</sub> based |               |
| 2   | Inner electrode  | Ni                       |               |
| 3   | Termination      | Inner layer              | Cu            |
| 4   |                  | Middle layer             | Ni            |
| 5   |                  | Outer layer              | Sn (Matt)     |

**Storage and handling conditions**

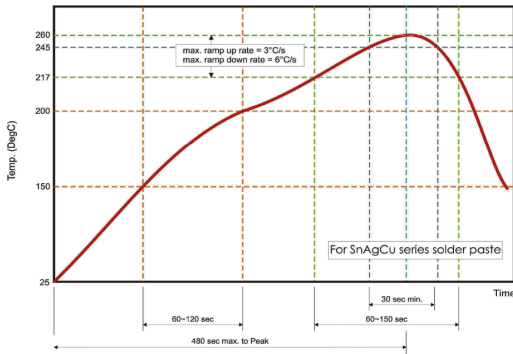
- (1) To store products at 5°C to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

**Cautions:**

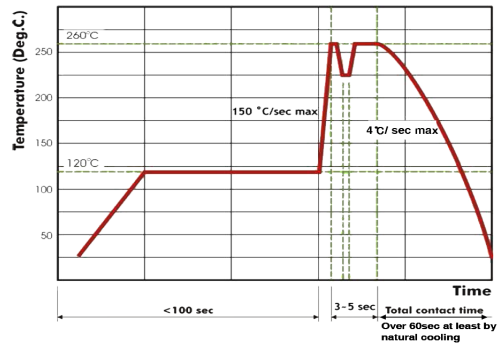
- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded,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

**Recommended Soldering Conditions:**

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



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



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

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