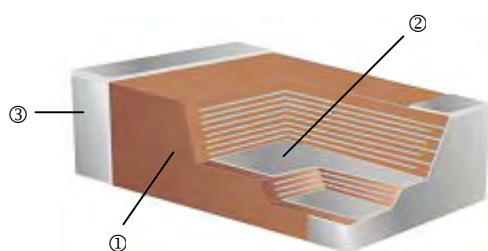


## Multilayer Ceramic Chip Capacitor

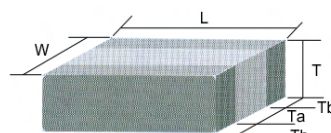
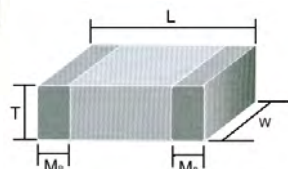
### Features

- Wide capacitance range, extremely compact size
- Low inductance of capacitor for high frequency application
- Excellent solderability and resistance to soldering heat, suitable for flow and reflow soldering
- Adaptable to high-speed surface mount assembly
- Conform to EIAJ-RC3402, and also compatible with EIA-RS198 and IEC PUB. 384-10

### Construction



|   |                  |   |                                                                |
|---|------------------|---|----------------------------------------------------------------|
| ① | Ceramic Material | ③ | Termination:                                                   |
| ② | Inner Electrodes |   | NPO: Ag/Ni/Sn dielectric<br>X7R, Y5V, X5R: Cu/Ni/Sn dielectric |



Unit: mm

### Dimensions

MC / MCHL / MCRF Type

| Type | Size (Inch) | L                             | W                     | T / Symbol            |                 | M <sub>B</sub>              | Packaging (7" Reel) |              |    |
|------|-------------|-------------------------------|-----------------------|-----------------------|-----------------|-----------------------------|---------------------|--------------|----|
|      |             |                               |                       |                       |                 |                             | Paper tape          | Plastic tape |    |
| 01   | 0201        | 0.6±0.03                      | 0.3±0.03              | 0.3±0.03              | L               | 0.15±0.05                   | 15K                 | -            |    |
| 02   | 0402        | 1.00±0.05                     | 0.50±0.05             | 0.50±0.05             | N               | 0.25<br>+0.05 / -0.10       | 10K                 | -            |    |
| 03   | 0603        | 1.60±0.10                     | 0.80±0.10             | 0.80±0.10             | S               | 0.40±0.15                   | 4K                  | -            |    |
|      |             | 1.60<br>+0.15 / -0.10         | 0.80<br>+0.15 / -0.10 | 0.80<br>+0.15 / -0.10 | X               |                             | 4K                  |              |    |
| 05   | 0805        | 2.00±0.15                     | 1.25±0.20             | 0.60±0.15             | A               | 0.50±0.20                   | 4K                  | -            |    |
|      |             |                               |                       | 0.80±0.10             | B               |                             | 4K                  | -            |    |
|      |             |                               |                       | 1.25±0.10             | D               |                             | -                   | 3K           |    |
|      |             | 0.85±0.10                     |                       | T                     | 4K              |                             | -                   |              |    |
|      |             | 2.00±0.20                     |                       | 1.25±0.20             | I               |                             | -                   | 3K           |    |
| 06   | 1206        | 3.20±0.15                     | 1.60±0.15             | 0.80±0.10             | B               | 0.60±0.20<br>(0.50±0.20)*** | 4K                  | -            |    |
|      |             |                               |                       | 0.95±0.10             | C               |                             | -                   | 3K           |    |
|      |             |                               |                       | 1.25±0.10             | D               |                             | -                   | 3K           |    |
|      |             | 3.20±0.20                     |                       | 1.15±0.15             | J               |                             | -                   | 3K           |    |
|      |             | 3.20±0.3 / -0.1               |                       | 1.60±0.20             | 1.60±0.20       |                             | G                   | -            | 2K |
|      |             |                               |                       | 1.60±0.3 / -0.1       | 1.60±0.3 / -0.1 |                             | P                   | -            | 2K |
| 10   | 1210        | 3.20±0.30                     | 2.50±0.20             | 0.95±0.10             | C               | 0.75±0.25                   | -                   | 3K           |    |
|      |             |                               |                       | 1.25±0.10             | D               |                             | -                   | 3K           |    |
|      |             | 3.20±0.40                     | 2.50±0.30             | 1.60±0.20             | G               |                             | -                   | 2K           |    |
|      |             |                               |                       | 2.00±0.20             | K               |                             | -                   | 1K           |    |
|      |             |                               |                       | 2.50±0.30             | M               |                             | -                   | 1K           |    |
| 08   | 1808        | 4.50±0.40<br>(4.5+0.5/-0.3)** | 2.03±0.25             | 1.25±0.10             | D               | 0.75±0.25<br>(0.50±0.20)*** | -                   | 2K           |    |
|      |             |                               |                       | 2.00±0.20             | K               |                             | -                   | 1K           |    |
| 12   | 1812        | 4.50±0.40<br>(4.5+0.5/-0.3)** | 3.20±0.30             | 1.25±0.10             | D               | 0.75±0.25<br>(0.50±0.20)*** | -                   | 1K           |    |
|      |             |                               |                       | 2.00±0.20             | K               |                             | -                   | 1K           |    |
|      |             |                               | 3.20±0.40             | 2.50±0.30             | M               |                             | -                   | 0.5K         |    |

\*\* For 1808/1812: 200~3KV, \*\*\*For 1206:1KV~3KV; 1808/1812: 200~3KV

Low Inductance Capacitors for MCLI Type

Unit: mm

| Type   | Size (Inch) | L         | W         | T / Symbol |   | Ta min. | Tb min. | Packaging (7" Reel) |              |
|--------|-------------|-----------|-----------|------------|---|---------|---------|---------------------|--------------|
|        |             |           |           |            |   |         |         | Paper tape          | Plastic tape |
| MCLI43 | 0612        | 3.20±0.15 | 1.60±0.15 | 0.80±0.10  | B | 0.5     | 0.13    | 4K                  | -            |

■ Part Numbering

| MC                                                                                                                                              | 03                                                                                                       | J                                                                                                                                                                                                                                                                                          | T                 | N                                          | 250                                                                                      | 3R9                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Product Type                                                                                                                                    | Dimensions (L×W)                                                                                         | Capacitance Tolerance                                                                                                                                                                                                                                                                      | Packaging         | Dielectric                                 | Voltage (VDCW)                                                                           | Capacitance                                                                    |
| MC : General; Ultra-small<br>Middle and High Voltage<br>MCHL: High Q and Low ESR<br>MCRF: Ultra High Q and Low ESR (RF)<br>MCLI: Low Inductance | 01: 0201<br>02: 0402<br>03: 0603<br>05: 0805<br>06: 1206<br>10: 1210<br>08: 1808<br>12: 1812<br>43: 0612 | B: $\pm 0.1\text{pF}$ ( $\text{Cap} \leq 5\text{pF}$ )<br>C: $\pm 0.25\text{pF}$ ( $\text{Cap} \leq 5\text{pF}$ )<br>D: $\pm 0.5\text{pF}$ ( $5\text{pF} < \text{Cap} < 10\text{pF}$ )<br>F: $\pm 1\%$<br>G: $\pm 2\%$<br>J: $\pm 5\%$<br>K: $\pm 10\%$<br>M: $\pm 20\%$<br>Z: $+80/-20\%$ | T: Taping<br>Reel | N: NPO (COG)<br>B: X7R<br>F: Y5V<br>X: X5R | 6V3: 6.3V<br>250: 25V<br>500: 50V<br>101: 100V<br>102: 1000V<br>202: 2000V<br>302: 3000V | 3R9: 3.9pF<br>150: 15pF<br>181: 180pF<br>225: 2.2μF<br>476: 47μF<br>107: 100μF |

■ Ultra-small 0201 Capacitors

Capacitance & Voltage

| EIA        | Size  | 0201           |                |                |
|------------|-------|----------------|----------------|----------------|
| Dielectric |       | NPO            |                |                |
| Code       | VDCW  | 16V            | 25V            | 50V            |
| 0R3        | 0.3pF |                | L <sup>^</sup> | L <sup>^</sup> |
| 0R4        | 0.4   |                | L <sup>^</sup> | L <sup>^</sup> |
| 0R5        | 0.5   |                | L <sup>^</sup> | L <sup>^</sup> |
| 1R0        | 1.0   |                | L <sup>^</sup> | L <sup>^</sup> |
| 1R2        | 1.2   |                | L <sup>^</sup> | L <sup>^</sup> |
| 1R5        | 1.5   |                | L <sup>^</sup> | L <sup>^</sup> |
| 1R8        | 1.8   |                | L <sup>^</sup> | L <sup>^</sup> |
| 2R2        | 2.2   |                | L <sup>^</sup> | L <sup>^</sup> |
| 2R7        | 2.7   |                | L <sup>^</sup> | L <sup>^</sup> |
| 3R3        | 3.3   |                | L <sup>^</sup> | L <sup>^</sup> |
| 3R9        | 3.9   |                | L <sup>^</sup> | L <sup>^</sup> |
| 4R0        | 4.0   |                | L <sup>^</sup> | L <sup>^</sup> |
| 4R7        | 4.7   |                | L <sup>^</sup> | L <sup>^</sup> |
| 5R6        | 5.6   |                | L <sup>^</sup> | L <sup>^</sup> |
| 6R8        | 6.8   |                | L <sup>^</sup> | L <sup>^</sup> |
| 8R2        | 8.2   |                | L <sup>^</sup> | L <sup>^</sup> |
| 100        | 10    |                | L <sup>^</sup> | L <sup>^</sup> |
| 120        | 12    |                | L <sup>^</sup> | L <sup>^</sup> |
| 150        | 15    |                | L <sup>^</sup> | L <sup>^</sup> |
| 180        | 18    |                | L <sup>^</sup> | L <sup>^</sup> |
| 220        | 22    |                | L <sup>^</sup> | L <sup>^</sup> |
| 270        | 27    |                | L <sup>^</sup> | L <sup>^</sup> |
| 330        | 33    |                | L <sup>^</sup> | L <sup>^</sup> |
| 390        | 39    |                | L <sup>^</sup> | L <sup>^</sup> |
| 470        | 47    |                | L <sup>^</sup> | L <sup>^</sup> |
| 560        | 56    | L <sup>^</sup> | L <sup>^</sup> |                |
| 680        | 68    | L <sup>^</sup> | L <sup>^</sup> |                |
| 820        | 82    | L <sup>^</sup> | L <sup>^</sup> |                |
| 101        | 100   | L <sup>^</sup> | L <sup>^</sup> |                |

| EIA        | Size    | 0201 |     |     |     |     |      |     |     |     |     |
|------------|---------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|
| Dielectric |         | X7R  |     |     |     |     | X5R  |     |     |     |     |
| Code       | VDCW    | 6.3V | 10V | 16V | 25V | 50V | 6.3V | 10V | 16V | 25V | 50V |
| 101        | 100pF   |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 121        | 120     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 151        | 150     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 181        | 180     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 221        | 220     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 271        | 270     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 331        | 330     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 391        | 390     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 471        | 470     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 561        | 560     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 681        | 680     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 821        | 820     |      |     | L   | L   | L   |      |     | L   | L   | L   |
| 102        | 1000    | L    | L   | L   | L   | L   |      |     | L   | L   | L   |
| 152        | 1500    | L    | L   | L   |     |     |      | L   | L   |     |     |
| 222        | 2200    | L    | L   | L   |     |     |      | L   | L   |     |     |
| 272        | 2700    | L    | L   | L   |     |     |      | L   | L   |     |     |
| 332        | 3300    | L    | L   | L   |     |     |      | L   | L   |     |     |
| 472        | 4700    | L    | L   | L   |     |     |      | L   | L   |     |     |
| 682        | 6800    | L    | L   |     |     |     |      | L   |     |     |     |
| 103        | 0.010μF | L    | L   | L   |     |     | L    | L   |     |     |     |
| 153        | 0.015   |      |     |     |     |     | L    | L   |     |     |     |
| 223        | 0.022   |      |     |     |     |     | L    | L   |     |     |     |
| 333        | 0.033   |      |     |     |     |     | L    | L   |     |     |     |
| 473        | 0.047   |      |     |     |     |     | L    | L   |     |     |     |
| 683        | 0.068   |      |     |     |     |     | L    | L   |     |     |     |
| 104        | 0.100   |      |     |     |     |     | L    | L   |     |     |     |
| 224        | 0.220   |      |     |     |     |     | L    |     |     |     |     |
| 474        | 0.470   |      |     |     |     |     | L    |     |     |     |     |

■ The letter in cell is expressed the symbol of product thickness

■ The “^” mark is expressed product with Ag/Ni/Sn terminations

# Multilayer Ceramic Chip Capacitor

## Electrical Data

| Size                        | 0201                                                                   |                                                                       |                                                                       |
|-----------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| Dielectric                  | NPO                                                                    | X7R                                                                   | X5R                                                                   |
| Capacitance*                | 0.3pF~100pF                                                            | 100pF~10nF                                                            | 100pF~0.47μF                                                          |
| Capacitance tolerance       | Cap≤5pF: C (±0.25pF)<br>5pF<Cap<10pF: D (±0.50pF)<br>Cap≥10pF: J (±5%) | J (±5%)<br>K (±10%)                                                   | K (±10%)<br>M (±20%)                                                  |
| Rated voltage (VDCW)        | 16V, 25V,50V                                                           | 6.3V,10V,16V, 25V, 50V                                                | 6.3V, 10V,16V,25V,50V                                                 |
| Tan δ/Q*                    | Cap<30pF: Q≥400 +20C<br>Cap≥30pF: Q≥1000                               | Ur=50V: ≤3.0%<br>Ur=16V, 25V: ≤3.5%<br>Ur=10V: ≤5.0%<br>Ur=6.3V: ≤10% | Ur=50V: ≤3.0%<br>Ur=16V, 25V: ≤3.5%<br>Ur=10V: ≤5.0%<br>Ur=6.3V: ≤10% |
| Insulation resistance at Ur | ≥10GΩ                                                                  | ≥10GΩ or R×C≥500Ω×F Whichever is less                                 |                                                                       |
| Operating temperature       | -55 to +125°C                                                          |                                                                       | -55 to +85°C                                                          |
| Capacitance change          | ±30 ppm                                                                | ±15%                                                                  |                                                                       |
| Termination                 | Ni/Sn (lead-free termination)                                          |                                                                       |                                                                       |

■ \*\*Measured at 30~70% related humidity

■ NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% at the condition of 25°C ambient temperature

■ X7R, X5R: Apply 1.0±0.2Vrms, 1.0KHz±10% at the condition of 25°C ambient temperature

■ Environmental Characteristics

| Item                                                   | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Test Method                                                                             |                                                                  |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------|--|-------|------|----|--------------------------------------------------------|-----|-------------|----|-------------------------------------------------|-----|------|----|----------------------------------------------------------------------|----|--------------------------------------------------------|------------------|----------------------------------------------------------------------|-----|-----------------------------|-------|---------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------|-------|------------------------------------------------------------------|-----|------------------------------------------------------------------------------------|-----|------------------------|------|-----|-----|------------------------------------------------------------------------------|-----|-------------|
| External Appearance                                    | No defects which may affect performance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Visual inspection & Dimension measurement                                               |                                                                  |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
| Capacitance(Cap.)                                      | Within the specified tolerance that refers on page2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NPO: (Class I)<br>Cap≤ 1000pF 1.0±0.2Vrms, 1MHz±10%<br>Cap>1000pF 1.0±0.2Vrms, 1KHz±10% |                                                                  |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
| Dissipation Factor (D.F.) or Quality factor (Q=1/D.F.) | NPO: Cap≥ 30pF, Q≥ 1000; Cap<30pF, Q≥ 400+20C<br>X7R, X5R:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |                                                                  |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | <table><tr><td>Rated vol.</td><td>D.F.≤</td><td colspan="2">Exception of D.F. ≤</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>7%</td><td>0603≥ 1μF; 0805≥ 1μF<br/>1206≥ 2.2μF; 1210≥ 10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">3.5%</td><td>5%</td><td>0201≥ 0.01μF; 0805≥ 1μF<br/>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<br/>0805≥ 2.2μF; 1206≥ 6.8μF<br/>1210≥ 22μF</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/>0603≥ 0.15μF; 0805≥ 0.68μF<br/>1206≥ 2.2μF; 1210≥ 4.7μF</td></tr><tr><td>10%</td><td>0402≥ 0.22μF; 0603≥ 0.68μF<br/>0805≥ 2.2μF; 1206≥ 4.7μF<br/>1210≥ 22μF</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<br/>1206≥ 2.2μF;1210≥ 22μF</td></tr><tr><td>15%</td><td>0201≥ 0.1μF; 0402≥ 1μF</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">10%</td><td>15%</td><td>0201≥ 0.01μF; 0402≥ 1μF<br/>0603≥ 10μF; 0805≥ 4.7μF<br/>1206≥ 47μF;1210≥ 100μF</td></tr><tr><td>20%</td><td>0402≥ 2.2μF</td></tr></table> |                                                                                         | Rated vol.                                                       | D.F.≤                                                                                 | Exception of D.F. ≤ |  | ≥ 50V | 2.5% | 3% | 0201(50V); 0603≥ 0.047μF<br>0805≥ 0.18μF; 1206≥ 0.47μF | 5%  | 1210≥ 4.7μF | 7% | 0603≥ 1μF; 0805≥ 1μF<br>1206≥ 2.2μF; 1210≥ 10μF | 25V | 3.5% | 5% | 0201≥ 0.01μF; 0805≥ 1μF<br>1210≥ 10μF                                | 7% | 0603≥ 0.33μF; 1206≥ 4.7μF                              | 10%              | 0402≥ 0.10μF; 0603≥ 0.47μF<br>0805≥ 2.2μF; 1206≥ 6.8μF<br>1210≥ 22μF | 16V | 3.5%                        | 5%    | 0201≥ 0.01μF; 0402≥ 0.033μF<br>0603≥ 0.15μF; 0805≥ 0.68μF<br>1206≥ 2.2μF; 1210≥ 4.7μF | 10%              | 0402≥ 0.22μF; 0603≥ 0.68μF<br>0805≥ 2.2μF; 1206≥ 4.7μF<br>1210≥ 22μF | 10V   | 5%                                                               | 10% | 0201≥ 0.012μF; 0402≥ 0.33μF<br>0603≥ 0.33μF; 0805≥ 2.2μF<br>1206≥ 2.2μF;1210≥ 22μF | 15% | 0201≥ 0.1μF; 0402≥ 1μF | 6.3V | 10% | 15% | 0201≥ 0.01μF; 0402≥ 1μF<br>0603≥ 10μF; 0805≥ 4.7μF<br>1206≥ 47μF;1210≥ 100μF | 20% | 0402≥ 2.2μF |
|                                                        | Rated vol.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | D.F.≤                                                                                   | Exception of D.F. ≤                                              |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | ≥ 50V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2.5%                                                                                    | 3%                                                               | 0201(50V); 0603≥ 0.047μF<br>0805≥ 0.18μF; 1206≥ 0.47μF                                |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 5%                                                               | 1210≥ 4.7μF                                                                           |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 7%                                                               | 0603≥ 1μF; 0805≥ 1μF<br>1206≥ 2.2μF; 1210≥ 10μF                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.5%                                                                                    | 5%                                                               | 0201≥ 0.01μF; 0805≥ 1μF<br>1210≥ 10μF                                                 |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 7%                                                               | 0603≥ 0.33μF; 1206≥ 4.7μF                                                             |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 10%                                                              | 0402≥ 0.10μF; 0603≥ 0.47μF<br>0805≥ 2.2μF; 1206≥ 6.8μF<br>1210≥ 22μF                  |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 16V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.5%                                                                                    | 5%                                                               | 0201≥ 0.01μF; 0402≥ 0.033μF<br>0603≥ 0.15μF; 0805≥ 0.68μF<br>1206≥ 2.2μF; 1210≥ 4.7μF |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 10%                                                              | 0402≥ 0.22μF; 0603≥ 0.68μF<br>0805≥ 2.2μF; 1206≥ 4.7μF<br>1210≥ 22μF                  |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5%                                                                                      | 10%                                                              | 0201≥ 0.012μF; 0402≥ 0.33μF<br>0603≥ 0.33μF; 0805≥ 2.2μF<br>1206≥ 2.2μF;1210≥ 22μF    |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 15%                                                              | 0201≥ 0.1μF; 0402≥ 1μF                                                                |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 6.3V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10%                                                                                     | 15%                                                              | 0201≥ 0.01μF; 0402≥ 1μF<br>0603≥ 10μF; 0805≥ 4.7μF<br>1206≥ 47μF;1210≥ 100μF          |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 20%                                                              | 0402≥ 2.2μF                                                                           |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | Y5V:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                         |                                                                  |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | <table><tr><td>Rated vol.</td><td>D.F.≤</td><td colspan="2">Exception of D.F. ≤</td></tr><tr><td>≥ 50V</td><td>5%</td><td>7%</td><td>0603≥ 0.1μF; 0805≥ 0.47μF<br/>1206≥ 4.7uF</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<br/>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;1.0μF)</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<br/>1206≥ 10μF; 1210≥ 22μF<br/>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></table>                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | Rated vol.                                                       | D.F.≤                                                                                 | Exception of D.F. ≤ |  | ≥ 50V | 5%   | 7% | 0603≥ 0.1μF; 0805≥ 0.47μF<br>1206≥ 4.7uF               | 35V | 7%          | —  | —                                               | 25V | 5%   | 7% | 0402≥ 0.047μF; 0603≥ 0.1μF<br>0805≥ 0.33μF; 1206≥ 1μF<br>1210≥ 4.7μF | 9% | 0402≥ 0.068μF; 0603≥ 0.47μF<br>1206≥ 4.7μF; 1210≥ 22μF | 16V<br>(C<1.0μF) | 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<br>1206≥ 10μF; 1210≥ 22μF<br>1812≥ 47μF | 10V | 12.5%                                                                              | 20% | 0402≥ 0.47μF           | 6.3V | 20% | -   | -                                                                            |     |             |
|                                                        | Rated vol.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | D.F.≤                                                                                   | Exception of D.F. ≤                                              |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | ≥ 50V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5%                                                                                      | 7%                                                               | 0603≥ 0.1μF; 0805≥ 0.47μF<br>1206≥ 4.7uF                                              |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 35V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7%                                                                                      | —                                                                | —                                                                                     |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5%                                                                                      | 7%                                                               | 0402≥ 0.047μF; 0603≥ 0.1μF<br>0805≥ 0.33μF; 1206≥ 1μF<br>1210≥ 4.7μF                  |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                         | 9%                                                               | 0402≥ 0.068μF; 0603≥ 0.47μF<br>1206≥ 4.7μF; 1210≥ 22μF                                |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
|                                                        | 16V<br>(C<1.0μF)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 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<br>1206≥ 10μF; 1210≥ 22μF<br>1812≥ 47μF |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
| 10V                                                    | 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20%                                                                                     | 0402≥ 0.47μF                                                     |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
| 6.3V                                                   | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -                                                                                       | -                                                                |                                                                                       |                     |  |       |      |    |                                                        |     |             |    |                                                 |     |      |    |                                                                      |    |                                                        |                  |                                                                      |     |                             |       |                                                                                       |                  |                                                                      |       |                                                                  |     |                                                                                    |     |                        |      |     |     |                                                                              |     |             |
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## Multilayer Ceramic Chip Capacitor

| Item                                                                      | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
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| Insulation Resistance                                                     | 10GΩ or R×C≥ 500Ω·F Whichever is smaller<br>X7R, X5R, Y5V:                                                                                                                                                                                                                                                                                                                                                                                                                               | To apply rated voltage for max. 120sec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
|                                                                           | <table><tr><td>Rated Voltage</td><td>Insulation Resistance</td></tr><tr><td>100V: X7R</td><td rowspan="5">RxC ≥ 100Ω·F</td></tr><tr><td>50V: 0603≥1uF;0805≥1uF;1206≥2.2uF<br/>1210≥4.7uF</td></tr><tr><td>25V: 0402≥1uF;0603≥2.2uF;0805≥2.2uF<br/>1206≥10uF;1210≥10uF</td></tr><tr><td>16V: 0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br/>1206≥10uF;1210≥47uF</td></tr><tr><td>10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br/>0805≥2.2uF;1206≥4.7uF;1210≥47uF</td></tr><tr><td>6.3V</td></tr></table> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Rated Voltage         | Insulation Resistance | 100V: X7R    | RxC ≥ 100Ω·F | 50V: 0603≥1uF;0805≥1uF;1206≥2.2uF<br>1210≥4.7uF | 25V: 0402≥1uF;0603≥2.2uF;0805≥2.2uF<br>1206≥10uF;1210≥10uF | 16V: 0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br>1206≥10uF;1210≥47uF | 10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br>0805≥2.2uF;1206≥4.7uF;1210≥47uF | 6.3V      |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
|                                                                           | Rated Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Insulation Resistance |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
|                                                                           | 100V: X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | RxC ≥ 100Ω·F          |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
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| 25V: 0402≥1uF;0603≥2.2uF;0805≥2.2uF<br>1206≥10uF;1210≥10uF                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| 16V: 0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br>1206≥10uF;1210≥47uF              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| 10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br>0805≥2.2uF;1206≥4.7uF;1210≥47uF |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
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| ≥ 10GΩ or 100Ω ·F whichever is smaller<br>Rated voltage: 200V~630V        | To apply rated voltage(500V max.) for 60sec.                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| ≥ 10GΩ<br>Rated voltage: >630V                                            | To apply 500V for 60sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Temperature Characteristic of Capacitance                                 | <table><tr><td>T.C.</td><td>Capacitance Change</td></tr><tr><td>NPO</td><td>±30 (ppm/°C)</td></tr><tr><td>X7R</td><td>±15%</td></tr><tr><td>X5R</td><td>±15%</td></tr><tr><td>Y5V</td><td>+30%~-80%</td></tr></table>                                                                                                                                                                                                                                                                    | T.C.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Capacitance Change    | NPO                   | ±30 (ppm/°C) | X7R          | ±15%                                            | X5R                                                        | ±15%                                                         | Y5V                                                                       | +30%~-80% | With no electrical load.<br><table><tr><td>T.C.</td><td>Operating Temp</td></tr><tr><td>NPO</td><td>-55 ~ 125℃ at 25℃</td></tr><tr><td>X7R</td><td>-55 ~ 125℃ at 25℃</td></tr><tr><td>X5R</td><td>-55 ~ 85℃ at 25℃</td></tr><tr><td>Y5V</td><td>-25 ~ 85℃ at 20℃</td></tr></table> | T.C.                      | Operating Temp | NPO | -55 ~ 125℃ at 25℃ | X7R | -55 ~ 125℃ at 25℃ | X5R | -55 ~ 85℃ at 25℃ | Y5V | -25 ~ 85℃ at 20℃ |
| T.C.                                                                      | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| NPO                                                                       | ±30 (ppm/°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| X7R                                                                       | ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| X5R                                                                       | ±15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Y5V                                                                       | +30%~-80%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| T.C.                                                                      | Operating Temp                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| NPO                                                                       | -55 ~ 125℃ at 25℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| X7R                                                                       | -55 ~ 125℃ at 25℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| X5R                                                                       | -55 ~ 85℃ at 25℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Y5V                                                                       | -25 ~ 85℃ at 20℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Adhesive Strength of Termination                                          | No remarkable damage or removal of the terminations                                                                                                                                                                                                                                                                                                                                                                                                                                      | Pressurizing force:<br>0201:2N<br>0402&0603:5N>0603:10N<br>Test time: 10±1 sec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Vibration Resistance                                                      | No remarkable damage<br>Cap change and Q/D.F.: To meet initial spec                                                                                                                                                                                                                                                                                                                                                                                                                      | Vibration frequency: 10~55Hz/min<br>Total amplitude: 1.5mm<br>Test time: 6hrs.(two hrs each in three mutually Perpendicular directions.)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Solderability                                                             | 95% min. coverage of all metalized area.                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Solder temperature: 235±5℃<br>Dipping time: 2±0.5 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Bending Test                                                              | No remarkable damage<br>Cap change:<br>NPO: within±5% or 0.5pF whichever is larger<br>X7R, X5R: 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.)                                                                                                                                                                                                         | The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm and then the pressure shall be maintained for 5±1sec.<br>Measurement to be made after keeping at room temp. for 24±2hrs(Class I) or 48±4hrs(Class II)<br>(Thickness>1.0mm, Thickness≤1.0mm)                                                                                                                                                                                                                                                |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Resistance to Soldering Heat                                              | No remarkable damage<br>Cap change:<br>NPO: within±2.5% or 0.25pF whichever is larger<br>X7R, X5R: 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.                                                                                                                                                                                                                                               | Solder temperature: 260±5℃<br>Dipping time: 10±1sec<br>Preheating: 120 to 150℃ for 1minute before immerse the capacitor in a eutectic solder.<br>Before initial measurement(Class II only): Perform 150+0/-10℃ for 1hr and then set for 24±4hrs at room temp.<br>Measurement to be made after keep at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                   |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |
| Temperature Cycle                                                         | No remarkable damage.<br>Cap change:<br>NPO: within±2.5% or 0.25pF whichever is larger<br>X7R, X5R: within±7.5%<br>Y5V: within±20%<br>Q/D.F., I.R. and dielectric strength: To meet initial requirements.                                                                                                                                                                                                                                                                                | Conduct the five cycles according to the temperature and time. <table><tr><th>Step</th><th>Temp.(℃)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min. operating temp.+0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp</td><td>2-3</td></tr><tr><td>3</td><td>Max. operating temp.+3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2-3</td></tr></table> Before initial measurement(Cass II only): Perform 150+0/-10℃ for 1hr and then set for 48±4 hrs at room temp.<br>Measurement to be made after keeping at room temp. for 24±2 hrs.(Class I) or 48±4 hrs.(Class II). | Step                  | Temp.(℃)              | 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 |                   |     |                  |     |                  |
| Step                                                                      | Temp.(℃)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                       |              |              |                                                 |                                                            |                                                              |                                                                           |           |                                                                                                                                                                                                                                                                                    |                           |                |     |                   |     |                   |     |                  |     |                  |

# Multilayer Ceramic Chip Capacitor

| Item                                                                      | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Test Method         |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
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| Humidity<br>(steady state)                                                | <p>No remarkable damage.<br/>Cap change:<br/>NPO: within±5% or 0.5pF whichever is large<br/>X7R, X5R:≥ 10V, within±12.5%; 6.3V, within±25%<br/>Y5V:≥ 10V, within±30%; 6.3V, within+30/-40%<br/>Q/D.F. value:<br/>NPO: More than 30pF Q≥ 350, 10pF≤ C≤ 30pF, Q≥ 275+2.5C<br/>Less than 10pF Q≥ 200+10C<br/>X7R, X5R:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥50V</td><td rowspan="3">3.0%</td><td>6%</td><td>0201(50V);0603 ≥0.047μF<br/>0805 ≥0.18μF;1206 ≥0.47μF</td></tr><tr><td>10%</td><td>1210 ≥4.7μF</td></tr><tr><td>20%</td><td>0603 ≥1μF;0805 ≥1μF<br/>1206 ≥2.2μF;1210 ≥10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">5.0%</td><td>10%</td><td>0201 ≥0.01μF;0805 ≥1μF<br/>1210 ≥10μF</td></tr><tr><td>14%</td><td>0603 ≥0.33μF;1206 ≥4.7μF</td></tr><tr><td>15%</td><td>0402 ≥0.1μF;0603 ≥0.47μF<br/>0805 ≥2.2μF;1206 ≥6.8μF<br/>1210 ≥22μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">5%</td><td>10%</td><td>0603 ≥0.15μF;0603 ≥0.68μF<br/>1206 ≥2.2μF;1210 ≥4.7μF</td></tr><tr><td>15%</td><td>0201 ≥0.01μF;0402 ≥0.033μF<br/>0603 ≥0.68μF;0805 ≥2.2μF<br/>1206 ≥4.7μF;1210 ≥22μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">7.5%</td><td>15%</td><td>0201 ≥0.012μF;0402 ≥0.33μF<br/>0603 ≥0.33μF;0805 ≥2.2μF<br/>1206 ≥2.2μF;1210 ≥22μF</td></tr><tr><td>20%</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<br/>0603 ≥10μF;0805 ≥4.7μF<br/>1210 ≥100μF</td></tr></table> <p>Y5V:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td>≥50 V</td><td>7.5%</td><td>10%</td><td>0603 ≥0.1μF;0805 ≥0.47μF<br/>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<br/>0805 ≥0.33μF;1206 ≥1μF<br/>1210 ≥4.7μF</td></tr><tr><td>15%</td><td>0402 ≥0.068μF;0603 ≥0.47μF<br/>1206 ≥4.7μF;1210 ≥22μF</td></tr><tr><td rowspan="2">16V<br/>(C&lt;1.0μF)</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≥.0μF)</td><td>12.5%</td><td>20%</td><td>0603 ≥2.2μF;0805 ≥3.3μF<br/>1206 ≥10μF;1210 ≥22μF<br/>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></table> <p>I.R.: ≥ 10V 1GΩ or 50Ω·F whichever is smaller.<br/>Class II (X7R, X5R, Y5V)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V:X7R</td><td rowspan="5">RxC≥ 10Ω·F</td></tr><tr><td>50V:0603≥1uF;0805≥1uF;1206≥2.2uF<br/>1210≥4.7uF</td></tr><tr><td>25V:0402≥1uF;0603≥2.2uF 0805≥2.2uF;<br/>1206≥10uF;1210≥10uF</td></tr><tr><td>16V:0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br/>1206≥10uF;1210≥47uF</td></tr><tr><td>10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br/>0805≥2.2uF;1206≥4.7uF;1210≥47uF</td></tr></table> | Rated vol.          | D.F. ≤                                                                           | Exception of D.F. ≤ |  | ≥50V | 3.0% | 6% | 0201(50V);0603 ≥0.047μF<br>0805 ≥0.18μF;1206 ≥0.47μF | 10% | 1210 ≥4.7μF | 20% | 0603 ≥1μF;0805 ≥1μF<br>1206 ≥2.2μF;1210 ≥10μF | 25V | 5.0% | 10% | 0201 ≥0.01μF;0805 ≥1μF<br>1210 ≥10μF | 14% | 0603 ≥0.33μF;1206 ≥4.7μF | 15% | 0402 ≥0.1μF;0603 ≥0.47μF<br>0805 ≥2.2μF;1206 ≥6.8μF<br>1210 ≥22μF | 16V | 5% | 10% | 0603 ≥0.15μF;0603 ≥0.68μF<br>1206 ≥2.2μF;1210 ≥4.7μF | 15% | 0201 ≥0.01μF;0402 ≥0.033μF<br>0603 ≥0.68μF;0805 ≥2.2μF<br>1206 ≥4.7μF;1210 ≥22μF | 10V | 7.5% | 15% | 0201 ≥0.012μF;0402 ≥0.33μF<br>0603 ≥0.33μF;0805 ≥2.2μF<br>1206 ≥2.2μF;1210 ≥22μF | 20% | 0201 ≥0.1μF;0402 ≥1μF | 6.3V | 15% | 30% | 0201 ≥0.1μF;0402 ≥1μF<br>0603 ≥10μF;0805 ≥4.7μF<br>1210 ≥100μF | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥50 V | 7.5% | 10% | 0603 ≥0.1μF;0805 ≥0.47μF<br>1206 ≥4.7μF | 35V | 10% | — | — | 25V | 7.5% | 10% | 0402 ≥0.047μF;0603 ≥0.1μF<br>0805 ≥0.33μF;1206 ≥1μF<br>1210 ≥4.7μF | 15% | 0402 ≥0.068μF;0603 ≥0.47μF<br>1206 ≥4.7μF;1210 ≥22μF | 16V<br>(C<1.0μF) | 10% | 12.5% | 0402 ≥0.068μF;0603 ≥0.68μF | 20% | 0402 ≥0.22μF | 16V<br>(C≥.0μF) | 12.5% | 20% | 0603 ≥2.2μF;0805 ≥3.3μF<br>1206 ≥10μF;1210 ≥22μF<br>1812 ≥47μF | 10V | 20% | 30% | 0402 ≥0.47μF | 6.3V | 30% | - | - | Rated voltage | Insulation Resistance | 100V:X7R | RxC≥ 10Ω·F | 50V:0603≥1uF;0805≥1uF;1206≥2.2uF<br>1210≥4.7uF | 25V:0402≥1uF;0603≥2.2uF 0805≥2.2uF;<br>1206≥10uF;1210≥10uF | 16V:0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br>1206≥10uF;1210≥47uF | 10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br>0805≥2.2uF;1206≥4.7uF;1210≥47uF | <p>Test temp: 40±2℃<br/>Humidity: 90~95% RH<br/>Test time: 500+24/-0hrs<br/>Measurement to be made after keeping at room temp. for 24±2hrs.</p> |
| Rated vol.                                                                | D.F. ≤                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Exception of D.F. ≤ |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| ≥50V                                                                      | 3.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6%                  | 0201(50V);0603 ≥0.047μF<br>0805 ≥0.18μF;1206 ≥0.47μF                             |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
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|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20%                 | 0603 ≥1μF;0805 ≥1μF<br>1206 ≥2.2μF;1210 ≥10μF                                    |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 25V                                                                       | 5.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10%                 | 0201 ≥0.01μF;0805 ≥1μF<br>1210 ≥10μF                                             |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14%                 | 0603 ≥0.33μF;1206 ≥4.7μF                                                         |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 15%                 | 0402 ≥0.1μF;0603 ≥0.47μF<br>0805 ≥2.2μF;1206 ≥6.8μF<br>1210 ≥22μF                |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 16V                                                                       | 5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10%                 | 0603 ≥0.15μF;0603 ≥0.68μF<br>1206 ≥2.2μF;1210 ≥4.7μF                             |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 15%                 | 0201 ≥0.01μF;0402 ≥0.033μF<br>0603 ≥0.68μF;0805 ≥2.2μF<br>1206 ≥4.7μF;1210 ≥22μF |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 10V                                                                       | 7.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 15%                 | 0201 ≥0.012μF;0402 ≥0.33μF<br>0603 ≥0.33μF;0805 ≥2.2μF<br>1206 ≥2.2μF;1210 ≥22μF |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20%                 | 0201 ≥0.1μF;0402 ≥1μF                                                            |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 6.3V                                                                      | 15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 30%                 | 0201 ≥0.1μF;0402 ≥1μF<br>0603 ≥10μF;0805 ≥4.7μF<br>1210 ≥100μF                   |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| Rated vol.                                                                | D.F. ≤                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Exception of D.F. ≤ |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| ≥50 V                                                                     | 7.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10%                 | 0603 ≥0.1μF;0805 ≥0.47μF<br>1206 ≥4.7μF                                          |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 35V                                                                       | 10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | —                   | —                                                                                |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 25V                                                                       | 7.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10%                 | 0402 ≥0.047μF;0603 ≥0.1μF<br>0805 ≥0.33μF;1206 ≥1μF<br>1210 ≥4.7μF               |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 15%                 | 0402 ≥0.068μF;0603 ≥0.47μF<br>1206 ≥4.7μF;1210 ≥22μF                             |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 16V<br>(C<1.0μF)                                                          | 10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 12.5%               | 0402 ≥0.068μF;0603 ≥0.68μF                                                       |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20%                 | 0402 ≥0.22μF                                                                     |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 16V<br>(C≥.0μF)                                                           | 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 20%                 | 0603 ≥2.2μF;0805 ≥3.3μF<br>1206 ≥10μF;1210 ≥22μF<br>1812 ≥47μF                   |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 10V                                                                       | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 30%                 | 0402 ≥0.47μF                                                                     |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 6.3V                                                                      | 30%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -                   | -                                                                                |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| Rated voltage                                                             | Insulation Resistance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 100V:X7R                                                                  | RxC≥ 10Ω·F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 50V:0603≥1uF;0805≥1uF;1206≥2.2uF<br>1210≥4.7uF                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 25V:0402≥1uF;0603≥2.2uF 0805≥2.2uF;<br>1206≥10uF;1210≥10uF                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 16V:0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br>1206≥10uF;1210≥47uF               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |
| 10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br>0805≥2.2uF;1206≥4.7uF;1210≥47uF |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |                                                                                  |                     |  |      |      |    |                                                      |     |             |     |                                               |     |      |     |                                      |     |                          |     |                                                                   |     |    |     |                                                      |     |                                                                                  |     |      |     |                                                                                  |     |                       |      |     |     |                                                                |            |        |                     |  |       |      |     |                                         |     |     |   |   |     |      |     |                                                                    |     |                                                      |                  |     |       |                            |     |              |                 |       |     |                                                                |     |     |     |              |      |     |   |   |               |                       |          |            |                                                |                                                            |                                                             |                                                                           |                                                                                                                                                 |

# Multilayer Ceramic Chip Capacitor

| Item                                                                      | Requirement                                                                                                                                                                                                                                                                                                                 |                       |                     | Test Method                                                                                                                                                                                                       |                                                                                        |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Humidity<br>load                                                          | No remarkable damage.<br>Cap change:<br>NPO:±7.5% or 0.75pF whichever is larger<br>X7R, X5R: ≥ 10V, within±12.5%; 6.3V, within±25%<br>10V: 0603 ≥ 4.7μF;0402 ≥ 1μF; 0201 ≥ 0.1μF, within±25%<br>Y5V: ≥ 10V, within±30%; 6.3V, within+30/-40%<br>Q/D.F. value:<br>NPO: C ≥ 30pF,Q ≥ 200; C < 30pF,Q ≥ 100+10/3C<br>X7R, X5R: |                       |                     | Test temp: 40±2℃<br>Humidity: 90~95%RH<br>Test time: 500+24/-0 hrs<br>To apply voltage: Rated voltage(Max. 500V)<br>Measurement to be made after keeping at room temp for 24±2hrs.(Class I) or 48±4hrs.(Class II) |                                                                                        |
|                                                                           | Rated vol.                                                                                                                                                                                                                                                                                                                  | D.F. ≤                | Exception of D.F. ≤ |                                                                                                                                                                                                                   |                                                                                        |
|                                                                           | ≥ 50V                                                                                                                                                                                                                                                                                                                       | 3.0%                  | 6%                  |                                                                                                                                                                                                                   | 0201(50V);0603 ≥ 0.047μF<br>0805 ≥ 0.18μF; 1206 ≥ 0.47μF                               |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 10%                 |                                                                                                                                                                                                                   | 1210 ≥ 4.7μF                                                                           |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 20%                 |                                                                                                                                                                                                                   | 0603 ≥ 1μF;0805 ≥ 1μF<br>1206 ≥ 2.2μF;1210 ≥ 10μF                                      |
|                                                                           | 25V                                                                                                                                                                                                                                                                                                                         | 5.0%                  | 10%                 |                                                                                                                                                                                                                   | 0201 ≥ 0.01μF; 0805 ≥ 1μF<br>1210 ≥ 10μF                                               |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 14%                 |                                                                                                                                                                                                                   | 0603 ≥ 0.33μF;1206 ≥ 4.7μF                                                             |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 15%                 |                                                                                                                                                                                                                   | 0402 ≥ 0.10μF;0603 ≥ 0.47μF<br>0805 ≥ 2.2μF;1206 ≥ 6.8μF<br>1210 ≥ 22μF                |
|                                                                           | 16V                                                                                                                                                                                                                                                                                                                         | 5%                    | 10%                 |                                                                                                                                                                                                                   | 0603 ≥ 0.15μF;0805 ≥ 0.68μF<br>1206 ≥ 2.2μF;1210 ≥ 4.7μF                               |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 15%                 |                                                                                                                                                                                                                   | 0201 ≥ 0.01μF;0402 ≥ 0.033μF<br>0603 ≥ 0.68μF;0805 ≥ 2.2μF<br>1206 ≥ 4.7μF;1210 ≥ 22μF |
|                                                                           | 10V                                                                                                                                                                                                                                                                                                                         | 7.5%                  | 15%                 |                                                                                                                                                                                                                   | 0201 ≥ 0.012μF;0402 ≥ 0.33μF<br>0603 ≥ 0.33μF;0805 ≥ 2.2μF<br>1206 ≥ 2.2μF;1210 ≥ 22μF |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 20%                 |                                                                                                                                                                                                                   | 0201 ≥ 0.1μF;0402 ≥ 1μF                                                                |
|                                                                           | 6.3V                                                                                                                                                                                                                                                                                                                        | 15%                   | 30%                 |                                                                                                                                                                                                                   | 0201 ≥ 0.1μF;0402 ≥ 1μF<br>0603 ≥ 10μF;0805 ≥ 4.7μF<br>1210 ≥ 100μF                    |
|                                                                           | Y5V:                                                                                                                                                                                                                                                                                                                        |                       |                     |                                                                                                                                                                                                                   |                                                                                        |
|                                                                           | Rated vol.                                                                                                                                                                                                                                                                                                                  | D.F. ≤                | Exception of D.F. ≤ |                                                                                                                                                                                                                   |                                                                                        |
|                                                                           | ≥ 50 V                                                                                                                                                                                                                                                                                                                      | 7.5%                  | 10%                 |                                                                                                                                                                                                                   | 0603 ≥ 0.1μF;0805 ≥ 0.47μF<br>1206 ≥ 4.7μF                                             |
|                                                                           | 35V                                                                                                                                                                                                                                                                                                                         | 10%                   | —                   |                                                                                                                                                                                                                   | —                                                                                      |
|                                                                           | 25V                                                                                                                                                                                                                                                                                                                         | 7.5%                  | 10%                 |                                                                                                                                                                                                                   | 0402 ≥ 0.047μF;0603 ≥ 0.1μF<br>0805 ≥ 0.033μF; 1206 ≥ 1μF<br>1210 ≥ 4.7μF              |
|                                                                           |                                                                                                                                                                                                                                                                                                                             |                       | 15%                 |                                                                                                                                                                                                                   | 0402 ≥ 0.068μF; 0603 ≥ 0.1μF<br>1206 ≥ 4.7μF; 1210 ≥ 22μF                              |
|                                                                           | 16V<br>(C < 1.0μF)                                                                                                                                                                                                                                                                                                          | 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<br>1206 ≥ 10μF; 1210 ≥ 22μF<br>1812 ≥ 47μF                   |
|                                                                           | 10V                                                                                                                                                                                                                                                                                                                         | 20%                   | 30%                 |                                                                                                                                                                                                                   | 0402 ≥ 0.47μF                                                                          |
|                                                                           | 6.3V                                                                                                                                                                                                                                                                                                                        | 30%                   | -                   |                                                                                                                                                                                                                   | -                                                                                      |
|                                                                           | I.R.: ≥ 10V 500MΩ or 25Ω-F (Whichever is smaller)<br>Class II (X7R, X5R, Y5V)                                                                                                                                                                                                                                               |                       |                     |                                                                                                                                                                                                                   |                                                                                        |
| Rated voltage                                                             |                                                                                                                                                                                                                                                                                                                             | Insulation Resistance |                     |                                                                                                                                                                                                                   |                                                                                        |
| 100V:X7R                                                                  |                                                                                                                                                                                                                                                                                                                             | RxC ≥ 5Ω-F            |                     |                                                                                                                                                                                                                   |                                                                                        |
| 50V:0603≥1uF;0805≥1uF;1206≥2.2uF<br>1210≥4.7uF                            |                                                                                                                                                                                                                                                                                                                             |                       |                     |                                                                                                                                                                                                                   |                                                                                        |
| 25V:0402≥1uF;0603≥2.2uF 0805≥2.2uF;<br>1206≥10uF;1210≥10uF                |                                                                                                                                                                                                                                                                                                                             |                       |                     |                                                                                                                                                                                                                   |                                                                                        |
| 16V:0402≥ 0.22uF;0603≥1uF;0805≥2.2uF<br>1206≥10uF;1210≥47uF               |                                                                                                                                                                                                                                                                                                                             |                       |                     |                                                                                                                                                                                                                   |                                                                                        |
| 10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF<br>0805≥2.2uF;1206≥4.7uF;1210≥47uF |                                                                                                                                                                                                                                                                                                                             |                       |                     |                                                                                                                                                                                                                   |                                                                                        |
| 6.3V                                                                      |                                                                                                                                                                                                                                                                                                                             |                       |                     |                                                                                                                                                                                                                   |                                                                                        |



# Multilayer Ceramic Chip Capacitor

| Item                                                                                                                    | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|---------------|-------------------|------|---------|----------|----------------|------|---------|----------|----------------|------|---------|----------|----------------|------|---------|------|---------------|------|---------|------|---------------|-----|-------|----------------|
| High Temperature Load<br>(Endurance)                                                                                    | No remarkable damage.<br>Cap change:<br>NPO: $\pm 3\%$ or $\pm 0.3F$ whichever is larger<br>X7R, X5R: $\geq 10V$ , within $\pm 12.5\%$ ; 6.3V, within+30/-40%<br>10V:0603 $\geq 4.7\mu F$ ;0402 $\geq 1\mu F$ ;0201 $\geq 0.1\mu F$ , within $\pm 25\%$<br>Q/D.F. value:<br>NPO: More than 30pF, Q $\geq 350$<br>10pF $\leq C$ <30pF, Q $\geq 275+2.5C$<br>Less than 10pF, Q $\geq 200+10C$<br>X7R, X5R:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Test temp:<br>NPO, X7R: 125 $\pm 3^{\circ}C$<br>X5R, Y5V: 85 $\pm 3^{\circ}C$<br>Test Time: 1000+25/-0 hrs<br>To apply voltage:<br>(1.1) 100% of rated voltage for below range.                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                           |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                         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|                                                                                                                         | <table><tr><th>Rated vol.</th><th>D.F. <math>\leq</math></th><th colspan="2">Exception of D.F. <math>\leq</math></th></tr><tr><td rowspan="3"><math>\geq 50V</math></td><td rowspan="3">3.0%</td><td>6%</td><td>0201(50V) ;0603<math>\geq 0.047\mu F</math><br/>0805<math>\geq 0.18\mu F</math>; 1206<math>\geq 0.47\mu F</math></td></tr><tr><td>10%</td><td>1210<math>\geq 4.7\mu F</math></td></tr><tr><td>20%</td><td>0603<math>\geq 1\mu F</math>;0805<math>\geq 1\mu F</math><br/>1206<math>\geq 2.2\mu F</math>;1210<math>\geq 10\mu F</math></td></tr><tr><td rowspan="3">25V</td><td rowspan="3">5.0%</td><td>10%</td><td>0201<math>\geq 0.01\mu F</math>; 0805<math>\geq 1\mu F</math><br/>1210<math>\geq 10\mu F</math></td></tr><tr><td>14%</td><td>0603<math>\geq 0.33\mu F</math>;1206<math>\geq 4.7\mu F</math></td></tr><tr><td>15%</td><td>0402<math>\geq 0.10\mu F</math>;0603<math>\geq 0.47\mu F</math><br/>0805<math>\geq 2.2\mu F</math>;1206<math>\geq 6.8\mu F</math><br/>1210<math>\geq 22\mu F</math></td></tr><tr><td rowspan="2">16V</td><td rowspan="2">5%</td><td>10%</td><td>0603<math>\geq 0.15\mu F</math>;0805<math>\geq 0.68\mu F</math><br/>1206<math>\geq 2.2\mu F</math>;1210<math>\geq 4.7\mu F</math></td></tr><tr><td>15%</td><td>0201<math>\geq 0.01\mu F</math>;0402<math>\geq 0.033\mu F</math><br/>0603<math>\geq 0.68\mu F</math>;0805<math>\geq 2.2\mu F</math><br/>1206<math>\geq 4.7\mu F</math>;1210<math>\geq 22\mu F</math></td></tr><tr><td rowspan="2">10V</td><td rowspan="2">7.5%</td><td>15%</td><td>0201<math>\geq 0.012\mu F</math>;0402<math>\geq 0.33\mu F</math><br/>0603<math>\geq 0.33\mu F</math>;0805<math>\geq 2.2\mu F</math><br/>1206<math>\geq 2.2\mu F</math>;1210<math>\geq 22\mu F</math></td></tr><tr><td>20%</td><td>0201<math>\geq 0.1\mu F</math>;0402<math>\geq 1\mu F</math></td></tr><tr><td>6.3V</td><td>15%</td><td>30%</td><td>0201<math>\geq 0.1\mu F</math>;0402<math>\geq 1\mu F</math><br/>0603<math>\geq 10\mu F</math>;0805<math>\geq 4.7\mu F</math><br/>1210<math>\geq 100\mu F</math></td></tr></table> | Rated vol.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | D.F. $\leq$                                                                                                                               | Exception of D.F. $\leq$                                                                                          |                              | $\geq 50V$                                                                   | 3.0%                                                                                             | 6%                                                                                               | 0201(50V) ;0603 $\geq 0.047\mu F$<br>0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$                                      | 10%            | 1210 $\geq 4.7\mu F$ | 20% | 0603 $\geq 1\mu F$ ;0805 $\geq 1\mu F$<br>1206 $\geq 2.2\mu F$ ;1210 $\geq 10\mu F$ | 25V  | 5.0%    | 10%     | 0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$<br>1210 $\geq 10\mu F$                                                  | 14% | 0603 $\geq 0.33\mu F$ ;1206 $\geq 4.7\mu F$                                                 | 15%                     | 0402 $\geq 0.10\mu F$ ;0603 $\geq 0.47\mu F$<br>0805 $\geq 2.2\mu F$ ;1206 $\geq 6.8\mu F$<br>1210 $\geq 22\mu F$ | 16V     | 5%                                             | 10%            | 0603 $\geq 0.15\mu F$ ;0805 $\geq 0.68\mu F$<br>1206 $\geq 2.2\mu F$ ;1210 $\geq 4.7\mu F$ | 15%                         | 0201 $\geq 0.01\mu F$ ;0402 $\geq 0.033\mu F$<br>0603 $\geq 0.68\mu F$ ;0805 $\geq 2.2\mu F$<br>1206 $\geq 4.7\mu F$ ;1210 $\geq 22\mu F$ | 10V | 7.5%                                                                                                           | 15% | 0201 $\geq 0.012\mu F$ ;0402 $\geq 0.33\mu F$<br>0603 $\geq 0.33\mu F$ ;0805 $\geq 2.2\mu F$<br>1206 $\geq 2.2\mu F$ ;1210 $\geq 22\mu F$ | 20% | 0201 $\geq 0.1\mu F$ ;0402 $\geq 1\mu F$ | 6.3V | 15% | 30% | 0201 $\geq 0.1\mu F$ ;0402 $\geq 1\mu F$<br>0603 $\geq 10\mu F$ ;0805 $\geq 4.7\mu F$<br>1210 $\geq 100\mu F$ | <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr><tr><td>0201</td><td>X5R,X7R</td><td>6.3V,10V</td><td>C<math>\geq 0.1uF</math></td></tr><tr><td>0402</td><td>X5R,X7R</td><td>6.3V,10V</td><td>C<math>\geq 1.0uF</math></td></tr><tr><td>0603</td><td>X5R,X7R</td><td>6.3V,10V</td><td>C<math>\geq 4.7uF</math></td></tr><tr><td>0805</td><td>X5R,X7R</td><td>6.3V</td><td>C<math>\geq 22uF</math></td></tr><tr><td rowspan="2">1206</td><td>X5R,X7R</td><td>6.3V</td><td>C<math>\geq 47uF</math></td></tr><tr><td>NPO</td><td>3000V</td><td>C<math>\geq 1.5pF</math></td></tr></table> | Size | Dielectric | Rated voltage | Capacitance range | 0201 | X5R,X7R | 6.3V,10V | C $\geq 0.1uF$ | 0402 | X5R,X7R | 6.3V,10V | C $\geq 1.0uF$ | 0603 | X5R,X7R | 6.3V,10V | C $\geq 4.7uF$ | 0805 | X5R,X7R | 6.3V | C $\geq 22uF$ | 1206 | X5R,X7R | 6.3V | C $\geq 47uF$ | NPO | 3000V | C $\geq 1.5pF$ |
|                                                                                                                         | Rated vol.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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|                                                                                                                         | $\geq 50V$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6%                                                                                                                                        | 0201(50V) ;0603 $\geq 0.047\mu F$<br>0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$                                |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
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F$ |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                       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| 15%                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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| 10V                                                                                                                     | 7.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| 6.3V                                                                                                                    | 15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| Size                                                                                                                    | Dielectric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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| 0201                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 0402                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 0603                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 0805                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6.3V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | C $\geq 22uF$                                                                                                                             |                                                                                                                  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| 1206                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                                                                              | (1.2) 6.3V or C $\geq 10uF$ : 150% of rated voltage<br>(2) 10V $\leq U_r$ <500V: 200% of rated voltage.<br>150% of rated voltage for below range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                           |                                                                                                                  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                                                                                                                                              | <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr><tr><td rowspan="2">0402</td><td>X5R,X7R</td><td>10V,16V, 25V</td><td>C<math>\geq 1.0uF</math></td></tr><tr><td>Y5V</td><td>16V</td><td>C<math>\geq 0.47uF</math></td></tr><tr><td rowspan="2">0603</td><td>X5R,X7R</td><td>10V,16V</td><td>C<math>\geq 1.0uF</math></td></tr><tr><td>Y5V</td><td>16V</td><td>C<math>\geq 2.2uF</math></td></tr><tr><td rowspan="2">0805</td><td>X5R,X7R</td><td>10V</td><td>C<math>\geq 4.7uF</math></td></tr><tr><td>Y5V</td><td>16V</td><td>C<math>\geq 4.7uF</math></td></tr></table> | Size                                                                                                                                      | Dielectric                                                                                                        | Rated voltage                | Capacitance range                                                            | 0402                                                                                             | X5R,X7R                                                                                          | 10V,16V, 25V                                                                                                            | C $\geq 1.0uF$ | Y5V                  | 16V | C $\geq 0.47uF$                                                                     | 0603 | X5R,X7R | 10V,16V | C $\geq 1.0uF$                                                                                                     | Y5V | 16V                                                                                         | C $\geq 2.2uF$          | 0805                                                                                                              | X5R,X7R | 10V                                            | C $\geq 4.7uF$ | Y5V                                                                                        | 16V                         | C $\geq 4.7uF$                                                                                                                            |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                            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| Size                                                                                                                    | Dielectric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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| 0402                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 0603                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| 0805                                                                                                                    | X5R,X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                                                                              | (3) 500V: 150% of rated voltage<br>(4) $U_r \geq 630V$ : 120% of rated voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                           |                                                                                                                  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                                                                                                                                              | Test time: 1000+24/-0hrs<br>Measurement to be made after keeping at room temp. for 24 $\pm$ 2hrs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                           |                                                                                                                  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|                                                                                                                         | Y5V:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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|                                                                                                                         | <table><tr><th>Rated vol.</th><th>D.F. <math>\leq</math></th><th colspan="2">Exception of D.F. <math>\leq</math></th></tr><tr><td><math>\geq 50V</math></td><td>7.5%</td><td>10%</td><td>0603<math>\geq 0.1\mu F</math>;0805<math>\geq 0.47\mu F</math><br/>1206<math>\geq 4.7\mu F</math></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<math>\geq 0.047\mu F</math>;0603<math>\geq 0.1\mu F</math><br/>0805<math>\geq 0.33\mu F</math>; 1206<math>\geq 1\mu F</math><br/>1210<math>\geq 4.7\mu F</math></td></tr><tr><td>15%</td><td>0402<math>\geq 0.068\mu F</math>;0603<math>\geq 0.47\mu F</math><br/>1206<math>\geq 4.7\mu F</math>; 1210<math>\geq 22\mu F</math></td></tr><tr><td rowspan="2">16V<br/>(C&lt;1.0<math>\mu F</math>)</td><td rowspan="2">10%</td><td>12.5%</td><td>0402<math>\geq 0.068\mu F</math>; 0603<math>\geq 0.68\mu F</math></td></tr><tr><td>20%</td><td>0402<math>\geq 0.22\mu F</math></td></tr><tr><td>16V<br/>(C<math>\geq 1.0\mu F</math>)</td><td>12.5%</td><td>20%</td><td>0603<math>\geq 2.2\mu F</math>;0805<math>\geq 3.3\mu F</math><br/>1206<math>\geq 10\mu F</math>; 1210<math>\geq 22\mu F</math><br/>1812<math>\geq 47\mu F</math></td></tr><tr><td>10V</td><td>20%</td><td>30%</td><td>0402<math>\geq 0.47\mu F</math></td></tr><tr><td>6.3V</td><td>30%</td><td>-</td><td>-</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Rated vol.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | D.F. $\leq$                                                                                                                               | Exception of D.F. $\leq$                                                                                          |                              | $\geq 50V$                                                                   | 7.5%                                                                                             | 10%                                                                                              | 0603 $\geq 0.1\mu F$ ;0805 $\geq 0.47\mu F$<br>1206 $\geq 4.7\mu F$                                                     | 35V            | 10%                  | —   | —                                                                                   | 25V  | 7.5%    | 10%     | 0402 $\geq 0.047\mu F$ ;0603 $\geq 0.1\mu F$<br>0805 $\geq 0.33\mu F$ ; 1206 $\geq 1\mu F$<br>1210 $\geq 4.7\mu F$ | 15% | 0402 $\geq 0.068\mu F$ ;0603 $\geq 0.47\mu F$<br>1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$ | 16V<br>(C<1.0 $\mu F$ ) | 10%                                                                                                               | 12.5%   | 0402 $\geq 0.068\mu F$ ; 0603 $\geq 0.68\mu F$ | 20%            | 0402 $\geq 0.22\mu F$                                                                      | 16V<br>(C $\geq 1.0\mu F$ ) | 12.5%                                                                                                                                     | 20% | 0603 $\geq 2.2\mu F$ ;0805 $\geq 3.3\mu F$<br>1206 $\geq 10\mu F$ ; 1210 $\geq 22\mu F$<br>1812 $\geq 47\mu F$ | 10V | 20%                                                                                                                                       | 30% | 0402 $\geq 0.47\mu F$                    | 6.3V | 30% | -   | -                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
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| $\geq 50V$                                                                                                              | 7.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| 35V                                                                                                                     | 10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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 |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
| 25V                                                                                                                     | 7.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0402 $\geq 0.047\mu F$ ;0603 $\geq 0.1\mu F$<br>0805 $\geq 0.33\mu F$ ; 1206 $\geq 1\mu F$<br>1210 $\geq 4.7\mu F$                        |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
|                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0402 $\geq 0.068\mu F$ ;0603 $\geq 0.47\mu F$<br>1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$                                               |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
| 16V<br>(C<1.0 $\mu F$ )                                                                                                 | 10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0402 $\geq 0.068\mu F$ ; 0603 $\geq 0.68\mu F$                                                                                            |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
|                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0402 $\geq 0.22\mu F$                                                                                                                     |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                            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| 16V<br>(C $\geq 1.0\mu F$ )                                                                                             | 12.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0603 $\geq 2.2\mu F$ ;0805 $\geq 3.3\mu F$<br>1206 $\geq 10\mu F$ ; 1210 $\geq 22\mu F$<br>1812 $\geq 47\mu F$                            |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |               |                   |      |         |          |                |      |         |          |                |      |         |          |                |      |         |      |               |      |         |      |               |     |       |                |
| 10V                                                                                                                     | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0402 $\geq 0.47\mu F$                                                                                                                     |                                                                                                                   |                              |                                                                              |                                                                                                  |                                                                                                  |                                                                                                                         |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                         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| 6.3V                                                                                                                    | 30%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | - 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|                                                                                                                         | I.R.: $\geq 10V$ 1G $\Omega$ or 50 $\Omega$ -F whichever is smaller<br>Class II (X7R, X5R, Y5V)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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|                                                                                                                         | <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="5">RxC <math>\geq</math><br/>10<math>\Omega</math>-F</td></tr><tr><td>50V:0603<math>\geq 1uF</math>;0805<math>\geq 1uF</math>;1206<math>\geq 2.2uF</math><br/>1210<math>\geq 4.7uF</math></td></tr><tr><td>25V:0402<math>\geq 1uF</math>;0603<math>\geq 2.2uF</math> 0805<math>\geq 2.2uF</math>;<br/>1206<math>\geq 10uF</math>;1210<math>\geq 10uF</math></td></tr><tr><td>16V:0402<math>\geq 0.22uF</math>;0603<math>\geq 1uF</math>;0805<math>\geq 2.2uF</math><br/>1206<math>\geq 10uF</math>;1210<math>\geq 47uF</math></td></tr><tr><td>10V: 0201<math>\geq 47nF</math>;0402<math>\geq 0.47uF</math>;0603<math>\geq 0.47uF</math><br/>0805<math>\geq 2.2uF</math>;1206<math>\geq 4.7uF</math>;1210<math>\geq 47uF</math></td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Rated voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Insulation Resistance                                                                                                                     | 100V: X7R                                                                                                         | RxC $\geq$<br>10 $\Omega$ -F | 50V:0603 $\geq 1uF$ ;0805 $\geq 1uF$ ;1206 $\geq 2.2uF$<br>1210 $\geq 4.7uF$ | 25V:0402 $\geq 1uF$ ;0603 $\geq 2.2uF$ 0805 $\geq 2.2uF$ ;<br>1206 $\geq 10uF$ ;1210 $\geq 10uF$ | 16V:0402 $\geq 0.22uF$ ;0603 $\geq 1uF$ ;0805 $\geq 2.2uF$<br>1206 $\geq 10uF$ ;1210 $\geq 47uF$ | 10V: 0201 $\geq 47nF$ ;0402 $\geq 0.47uF$ ;0603 $\geq 0.47uF$<br>0805 $\geq 2.2uF$ ;1206 $\geq 4.7uF$ ;1210 $\geq 47uF$ |                |                      |     |                                                                                     |      |         |         |                                                                                                                    |     |                                                                                             |                         |                                                                                                                   |         |                                                |                |                                                                                            |                             |                                                                                                                                           |     |                                                                                                                |     |                                                                                                                                           |     |                                          |      |     |     |                                                                                                               |                                                                                                                                                                                                                                                                            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| Rated voltage                                                                                                           | Insulation Resistance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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| 100V: X7R                                                                                                               | RxC $\geq$<br>10 $\Omega$ -F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| 50V:0603 $\geq 1uF$ ;0805 $\geq 1uF$ ;1206 $\geq 2.2uF$<br>1210 $\geq 4.7uF$                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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| 25V:0402 $\geq 1uF$ ;0603 $\geq 2.2uF$ 0805 $\geq 2.2uF$ ;<br>1206 $\geq 10uF$ ;1210 $\geq 10uF$                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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| 16V:0402 $\geq 0.22uF$ ;0603 $\geq 1uF$ ;0805 $\geq 2.2uF$<br>1206 $\geq 10uF$ ;1210 $\geq 47uF$                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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| 10V: 0201 $\geq 47nF$ ;0402 $\geq 0.47uF$ ;0603 $\geq 0.47uF$<br>0805 $\geq 2.2uF$ ;1206 $\geq 4.7uF$ ;1210 $\geq 47uF$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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# Multilayer Ceramic Chip Capacitor

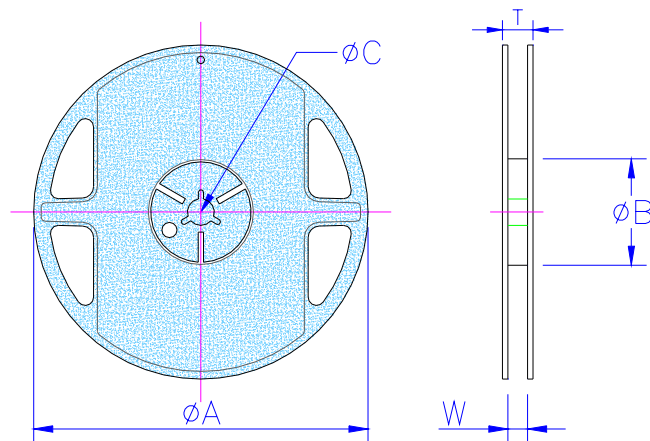
## ■Packaging

Packaging Quantity

Unit: mm

| Type | Thickness / Symbol |   | Packaging (7" Reel) |              |
|------|--------------------|---|---------------------|--------------|
|      |                    |   | Paper tape          | Plastic tape |
| 0201 | 0.30±0.03          | L | 15K                 | -            |
| 0402 | 0.50±0.05          | N | 10K                 | -            |
| 0603 | 0.80±0.10          | S | 4K                  | -            |
|      | 0.80 +0.15 / -0.10 | X | 4K                  | -            |
| 0805 | 0.60±0.10          | A | 4K                  | -            |
|      | 0.80±0.10          | B | 4K                  | -            |
|      | 0.85±0.10          | T | 4K                  | -            |
|      | 1.25±0.10          | D | -                   | 3K           |
|      | 1.25±0.20          | I | -                   | 3K           |
| 1206 | 0.80±0.10          | B | 4K                  | -            |
|      | 0.95±0.10          | C | -                   | 3K           |
|      | 1.15±0.15          | J | -                   | 3K           |
|      | 1.25±0.10          | D | -                   | 3K           |
|      | 1.60±0.20          | G | -                   | 2K           |
|      | 1.60 +0.30 / -0.10 | P | -                   | 2K           |
| 1210 | 0.95±0.10          | C | -                   | 3K           |
|      | 1.25±0.10          | D | -                   | 3K           |
|      | 1.60±0.20          | G | -                   | 2K           |
|      | 2.00±0.20          | K | -                   | 1K           |
|      | 2.50±0.30          | M | -                   | 1K           |
| 1808 | 1.25±0.10          | D | -                   | 2K           |
|      | 2.00±0.20          | K | -                   | 1K           |
| 1812 | 1.25±0.10          | D | -                   | 1K           |
|      | 2.00±0.20          | K | -                   | 1K           |
|      | 2.50±0.30          | M | -                   | 0.5K         |
| 0612 | 0.80±0.10          | B | 4K                  | -            |

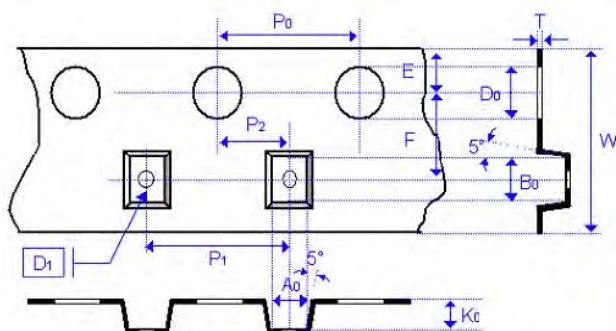
Tape and Reel



Unit: mm

| Type | Chip Size    |              |              |              |              |              |              |              |
|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|      | 0201         | 0402         | 0603         | 0805         | 1206/0612    | 1210         | 1808         | 1812         |
| ΦC   | 13.0±1.0     | 13.0±1.0     | 13.0±1.0     | 13.0±1.0     | 13.0±1.0     | 13.0±1.0     | 13.0±1.0     | 13.0±1.0     |
| W    | 9.0±1.0      | 9.0±1.0      | 9.0±1.0      | 9.0±1.0      | 9.0±1.0      | 9.0±1.0      | 13.5±1.0     | 13.5±1.0     |
| ΦA   | 178±1.0(7")  | 178±1.0(7")  | 178±1.0(7")  | 178±1.0(7")  | 178±1.0(7")  | 178±1.0(7")  | 178±1.0(7")  | 178±1.0(7")  |
| ΦB   | 60.5±1.0(7") | 60.5±1.0(7") | 60.5±1.0(7") | 60.5±1.0(7") | 60.5±1.0(7") | 60.5±1.0(7") | 80.0±1.0(7") | 80.0±1.0(7") |

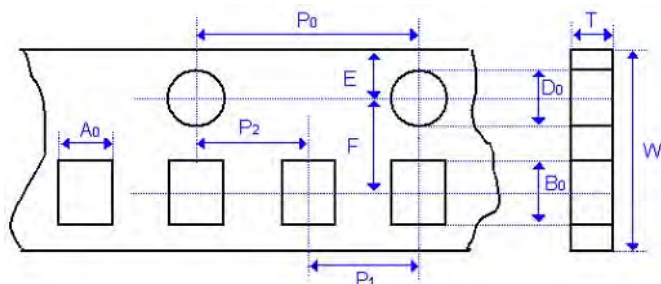
Plastic Tape Size Specification



Unit: mm

| Type           | 0805      |   | 1206      |   |   |           |   | 1210      |   |   |           |   | 1808      |       | 1812      |       |   |
|----------------|-----------|---|-----------|---|---|-----------|---|-----------|---|---|-----------|---|-----------|-------|-----------|-------|---|
| Thickness      | D         | I | C         | J | D | G         | P | C         | D | G | K         | M | D         | K     | D         | K     | M |
| A <sub>0</sub> | <1.57     |   | <1.85     |   |   | <1.95     |   | <2.97     |   |   | <2.97     |   | <2.35     |       | <3.81     |       |   |
| B <sub>0</sub> | <2.40     |   | <3.46     |   |   | <3.67     |   | <3.73     |   |   | <3.73     |   | <4.98     | <5.00 | <5.30     |       |   |
| T              | 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 |       |   |
| K <sub>0</sub> | <2.50     |   | <2.50     |   |   | <2.50     |   | <2.50     |   |   | <3.00     |   | <2.50     |       | <2.50     | <3.00 |   |
| W              | 8.00±0.10 |   | 8.00±0.10 |   |   | 8.00±0.10 |   | 8.00±0.10 |   |   | 8.00±0.10 |   | 12.0±0.20 |       | 12.0±0.20 |       |   |
| P <sub>0</sub> | 4.00±0.10 |   | 4.00±0.10 |   |   | 4.00±0.10 |   | 4.00±0.10 |   |   | 4.00±0.10 |   | 4.00±0.10 |       | 4.00±0.10 |       |   |
| P <sub>1</sub> | 4.00±0.10 |   | 4.00±0.10 |   |   | 4.00±0.10 |   | 4.00±0.10 |   |   | 4.00±0.10 |   | 4.00±0.10 |       | 8.00±0.10 |       |   |
| P <sub>2</sub> | 2.00±0.05 |   | 2.00±0.05 |   |   | 2.00±0.05 |   | 2.00±0.05 |   |   | 2.00±0.05 |   | 2.00±0.05 |       | 2.00±0.05 |       |   |
| D <sub>0</sub> | 1.50±0.05 |   | 1.50±0.05 |   |   | 1.50±0.05 |   | 1.50±0.05 |   |   | 1.50±0.05 |   | 1.50±0.05 |       | 1.50±0.05 |       |   |
| D <sub>1</sub> | 1.00±0.10 |   | 1.00±0.10 |   |   | 1.00±0.10 |   | 1.00±0.10 |   |   | 1.00±0.10 |   | 1.00±0.10 |       | 1.00±0.10 |       |   |
| E              | 1.75±0.10 |   | 1.75±0.10 |   |   | 1.75±0.10 |   | 1.75±0.10 |   |   | 1.75±0.10 |   | 1.75±0.10 |       | 1.75±0.10 |       |   |
| F              | 3.50±0.05 |   | 3.50±0.05 |   |   | 3.50±0.05 |   | 3.50±0.05 |   |   | 3.50±0.05 |   | 3.50±0.05 |       | 5.50±0.05 |       |   |

Paper Tape Size Specification



Unit: mm

| Type           | 0201      | 0402      | 0603      |   | 0805      |           | 1206/0612 |
|----------------|-----------|-----------|-----------|---|-----------|-----------|-----------|
| Thickness      | L         | N         | S         | X | A         | B         | B         |
| A <sub>0</sub> | 0.45±0.05 | 0.62±0.05 | 1.02±0.05 |   | 1.50±0.10 | 1.50±0.10 | 2.00±0.10 |
| B <sub>0</sub> | 0.75±0.05 | 1.12±0.05 | 1.82±0.05 |   | 2.30±0.10 | 2.30±0.10 | 3.50±0.10 |
| T              | 0.60±0.05 | 0.60±0.05 | 0.95±0.05 |   | 0.75±0.05 | 0.95±0.05 | 0.95±0.05 |
| W              | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 |   | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 |
| P <sub>0</sub> | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |   | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |
| P <sub>1</sub> | 2.00±0.05 | 2.00±0.05 | 4.00±0.10 |   | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |
| P <sub>2</sub> | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 |   | 2.00±0.05 | 2.00±0.05 | 2.00±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 | 1.50±0.05 |
| E              | 1.75±0.05 | 1.75±0.05 | 1.75±0.05 |   | 1.75±0.05 | 1.75±0.05 | 1.75±0.10 |
| F              | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 |   | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 |