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Date : 2022/01/03

APPROVAL SHEET

Product Name : Anti-Bend General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FP Series

Description : Anti-Bend Size 0402~2225, C0G/X7R, 25V~4000V

| PREPARED BY | APPROVED BY |
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| | |

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SPECIFICATION

FOR

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SPEC. No. : FP-000-001-18

DATE : 2022/01/03

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|-------------------|-------------------|------------------|
| <i>Jane Hsiao</i> | <i>Yvens Chou</i> | <i>Jason Lin</i> |

1. INTRODUCTION

POSPERITY Multilayer Ceramic Chip Capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards.

FP series use a special material between nickel-barrier and ceramic body. It provides excellent performance to against bending stress occurred during process and provide more security for PCB process.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

2. FEATURES

- High performance to withstanding 3~5mm of substrate bending test guarantee.
- A wide selection of sizes is available.
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- Reduction in PCB bend failure.
- High reliability and stability.
- RoHS & HALOGEN FREE.

4. HOW TO ORDER

3. APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.
- DC to DC converter.

| FP | 32 | X | 225 | K | 101 | E | G | G |
|------------|---------|------------|-------------|-----------|---------------|-----------|-----------|--------------|
| PDC Family | Size | Dielectric | Capacitance | Tolerance | Rated Voltage | Packaging | Thickness | Control Code |
| Table 1 | Table 2 | Table 3 | Table 4 | Table 5 | Table 6 | Table 7 | Table 8 | Table 9 |

| Table 1 | | PDC Family | |
|---------|-----------------------------------|------------|-------------|
| Code | Description | Code | Description |
| FP | Anti-Bend General Purpose Product | | |

| Table 2 | | General Purpose | | | |
|---------|-------------|-----------------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| 15 | 0402 (1005) | 32 | 1210 (3225) | 52 | 2211 (5728) |
| 18 | 0603 (1608) | 42 | 1808 (4520) | 55 | 2220 (5750) |
| 21 | 0805 (2012) | 43 | 1812 (4532) | 56 | 2225 (5763) |
| 31 | 1206 (3216) | 46 | 1825 (4563) | | |

| Table 3 | | Dielectric Material Characteristics | |
|---------|-------------|-------------------------------------|-------------|
| Code | Description | Code | Description |
| N | C0G | X | X7R |
| B | X5R | F | Y5V |

| Table 4 | | Capacitance Rule Code | |
|---------|------------------------------|-----------------------|--------------------------------|
| Code | Description | Code | Description |
| R47 | 0.47pF | 102 | 102=10x10 ² =1000pF |
| 0R5 | 0.5pF | 104 | 104=10x10 ⁴ =100nF |
| 100 | 100=10x10 ⁰ =10pF | 106 | 106=10x10 ⁶ =10μF |

| Table 5 | | Tolerance | | | |
|---------|-------------|-----------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| A | ±0.05 pF | I | -10% ~ 0% | Q | ±0.03 pF |
| B | ±0.10 pF | J | ±5 % | Z | -20% ~ +80% |
| C | ±0.25 pF | K | ±10 % | X | +10% ~ +20% |
| D | ±0.50 pF | L | 0% ~ +10% | | |
| F | ±1 % | M | ±20 % | | |
| G | ±2 % | N | -5% ~ +10% | | |
| H | ±3 % | P | ±0.02 pF | | |

| Table 6 | | Rated Voltage | | | |
|---------|-------------|---------------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| 6R3 | 6.3Vdc | 201 | 200Vdc | 152 | 1500Vdc |
| 100 | 10Vdc | 251 | 250Vdc | 202 | 2000Vdc |
| 160 | 16Vdc | 401 | 400Vdc | 302 | 3000Vdc |
| 250 | 25Vdc | 501 | 500Vdc | 402 | 4000Vdc |
| 500 | 50Vdc | 631 | 630Vdc | 502 | 5000Vdc |
| 101 | 100Vdc | 102 | 1000Vdc | 602 | 6000Vdc |

| Table 7 | | Packaging Type | |
|---------|----------------------------------|----------------|-------------------------------|
| Code | Description | Code | Description |
| B | Bulk | T | Tray package |
| E | Tape and 7" Reel, Embossed Tape | P | Tape and 7" Reel, Paper Tape |
| K | Tape and 10" Reel, Embossed Tape | D | Tape and 10" Reel, Paper Tape |
| L | Tape and 13" Reel, Embossed Tape | G | Tape and 13" Reel, Paper Tape |

| Table 8 | | Thickness Description | | | |
|---------|---------------------|-----------------------|--------------------|------|---------------------|
| Code | Description | Code | Description | Code | Description |
| A | 0.60 ± 0.10 mm | I | 1.25 ± 0.20 mm | Q | 0.50 +0.02/-0.05 mm |
| B | 0.8 + 0.15/-0.10 mm | J | 1.15 ± 0.15 mm | R | 3.10 ± 0.30 mm |
| C | 1.25 ± 0.10 mm | K | 0.50 ± 0.20 mm | S | 0.80 ± 0.07 mm |
| D | 1.40 ± 0.15 mm | L | 0.30 ± 0.03 mm | T | 0.85 ± 0.10 mm |
| E | 1.60 ± 0.20 mm | M | 0.95 ± 0.10 mm | U | 0.50 ± 0.10 mm |
| F | 2.00 ± 0.20 mm | N | 0.50 ± 0.05 mm | V | 0.20 ± 0.02 mm |
| G | 2.50 ± 0.30 mm | O | 3.50 ± 0.20 mm | X | 0.80 ± 0.10 mm |
| H | 2.80 ± 0.30 mm | P | 1.60 +0.3/-0.10 mm | Z | 0.25 ± 0.03 mm |

| Table 9 | | Special Control Code | |
|---------|----------------|----------------------|----------------------------------|
| Code | Description | Code | Description |
| G | RoHS Compliant | H | High reliability |
| | | Q | Surface Coating (Size 1206~2225) |

5. EXTERNAL DIMENSIONS

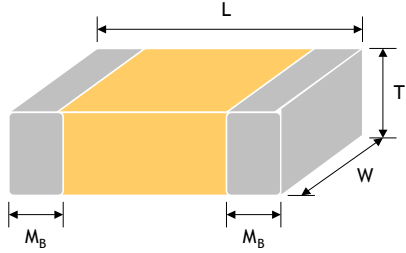
| Size Inch (mm) | L (mm) | W (mm) | Code / T (mm) | M _B (mm) | |
|----------------|-----------|--|----------------------------------|---------------------|---|
| 0402(1005) | 1.00±0.20 | 0.50±0.20 | See No.4 Reference Table 8 | 0.25 +0.05/-0.10 |  |
| 0603(1608) | 1.60±0.20 | 0.80±0.20 | | 0.40±0.15 | |
| 0805(2012) | 2.10±0.20 | 1.25±0.20 | | 0.50±0.20 | |
| 1206(3216) | 3.30±0.30 | 1.60±0.20 1.60 +0.30/-0.10 [#] | | 0.60±0.20 | |
| 1210(3225) | 3.30±0.40 | 2.50±0.30 | | 0.75±0.35 | |
| 1808(4520) | 4.60±0.50 | 2.00±0.25 | | 0.75±0.35 | |
| 1812(4532) | 4.60±0.50 | 3.20±0.30 | | 0.75±0.35 | |
| 1825(4563) | 4.60±0.50 | 6.30±0.40 | | 0.75±0.35 | |
| 2220(5750) | 5.70±0.50 | 5.00±0.40 | | 0.85±0.35 | |
| 2225(5763) | 5.70±0.50 | 6.30±0.40 | | 0.85±0.35 | |

Fig. 5.1 The outline of MLCC

[#] For 1206 size P thickness products.

6. GENERAL ELECTRICAL DATA

| Dielectric | C0G | X7R | | | | | | | | | | | | |
|------------------------------------|--|---|----------------|-------------|-------------------------|-------------|-------------------------|--|------------|----------------|-----------|-------------------------|-----------|------------------------|
| Size | 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225 | 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225 | | | | | | | | | | | | |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV, 4KV | 6.3V, 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV, 4KV | | | | | | | | | | | | |
| Capacitance range | 0.1pF ~ 330nF | 100pF ~ 22μF | | | | | | | | | | | | |
| Capacitance tolerance | Reference to Table 5 | Reference to Table 5 | | | | | | | | | | | | |
| Tan δ | <table border="1"> <thead> <tr> <th>Cap. Range</th> <th>Q Spec.</th> </tr> </thead> <tbody> <tr> <td>Cap.<30pF</td> <td>Q≥400+20C</td> </tr> <tr> <td>Cap.≥30pF</td> <td>Q≥1000</td> </tr> </tbody> </table> | Cap. Range | Q Spec. | Cap.<30pF | Q≥400+20C | Cap.≥30pF | Q≥1000 | Reference to 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS | | | | | | |
| Cap. Range | Q Spec. | | | | | | | | | | | | | |
| Cap.<30pF | Q≥400+20C | | | | | | | | | | | | | |
| Cap.≥30pF | Q≥1000 | | | | | | | | | | | | | |
| Capacitance & Tan δ Test condition | For 25°C at ambient temperature <table border="1"> <thead> <tr> <th>Cap. Range</th> <th>Test Condition</th> </tr> </thead> <tbody> <tr> <td>Cap.≤1000pF</td> <td>1.0±0.2Vrms, 1.0MHz±10%</td> </tr> <tr> <td>Cap.>1000pF</td> <td>1.0±0.2Vrms, 1.0KHz±10%</td> </tr> </tbody> </table> | Cap. Range | Test Condition | Cap.≤1000pF | 1.0±0.2Vrms, 1.0MHz±10% | Cap.>1000pF | 1.0±0.2Vrms, 1.0KHz±10% | Preconditioning for Class II MLCC : Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement <table border="1"> <thead> <tr> <th>Cap. Range</th> <th>Test Condition</th> </tr> </thead> <tbody> <tr> <td>Cap.≤10μF</td> <td>1.0±0.2Vrms, 1.0KHz±10%</td> </tr> <tr> <td>Cap.>10μF</td> <td>0.5±0.2Vrms, 120Hz±20%</td> </tr> </tbody> </table> | Cap. Range | Test Condition | Cap.≤10μF | 1.0±0.2Vrms, 1.0KHz±10% | Cap.>10μF | 0.5±0.2Vrms, 120Hz±20% |
| Cap. Range | Test Condition | | | | | | | | | | | | | |
| Cap.≤1000pF | 1.0±0.2Vrms, 1.0MHz±10% | | | | | | | | | | | | | |
| Cap.>1000pF | 1.0±0.2Vrms, 1.0KHz±10% | | | | | | | | | | | | | |
| Cap. Range | Test Condition | | | | | | | | | | | | | |
| Cap.≤10μF | 1.0±0.2Vrms, 1.0KHz±10% | | | | | | | | | | | | | |
| Cap.>10μF | 0.5±0.2Vrms, 120Hz±20% | | | | | | | | | | | | | |
| Insulation resistance | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | | | | | | | | | | | | |
| Operating temperature | -55°C to +125°C | -55°C to +125°C | | | | | | | | | | | | |
| Temperature coefficient | ±30ppm/°C | ±15% | | | | | | | | | | | | |
| Termination | Cu/Ag polymer/Ni/Sn(lead-free termination) | Cu/Ag polymer/Ni/Sn(lead-free termination) | | | | | | | | | | | | |

7. CAPACITANCE RANGE(Con.)

7-1. C0G

| Dimension | | 1206 | | | | | | | | | | 1210 | | | | | | | | | | |
|-----------|------|-------------------|-----|------|------|------|------|------|-------|-------|-------|-------------------|-----|------|------|------|------|------|-------|-------|-------|---|
| Cap.(pF) | Code | 10V 16V 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 1500V | 2000V | 10V 16V 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 1500V | 2000V | |
| 1.0 | 1R0 | | X | | | | | | | | | | | | | | | | | | | |
| 1.2 | 1R2 | X | X | X | | | X | | | | | | | | | | | | | | | |
| 1.5 | 1R5 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 1.8 | 1R8 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 2.2 | 2R2 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 2.7 | 2R7 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 3.3 | 3R3 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 3.9 | 3R9 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 4.7 | 4R7 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 5.0 | 5R0 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 5.6 | 5R6 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 6.8 | 6R8 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 8.2 | 8R2 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 10 | 100 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M |
| 12 | 120 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M |
| 15 | 150 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M |
| 18 | 180 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M |
| 22 | 220 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M |
| 27 | 270 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M |
| 33 | 330 | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M | M | M |
| 39 | 390 | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M | M | M |
| 47 | 470 | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | M | M | M | M |
| 56 | 560 | X | X | X | X | X | X | X | M | C | C | M | M | M | M | M | M | M | M | M | C | C |
| 68 | 680 | X | X | X | X | X | X | X | M | C | C | M | M | M | M | M | M | M | M | M | C | C |
| 82 | 820 | X | X | X | X | X | X | X | C | C | C | M | M | M | M | M | M | M | M | M | C | C |
| 100 | 101 | X | X | X | X | X | X | X | C | C | C | M | M | M | M | M | M | M | M | M | C | C |
| 120 | 121 | X | X | X | X | X | X | X | C | C | C | M | M | M | M | M | M | M | M | M | C | C |
| 150 | 151 | X | X | X | X | X | X | X | C | E | E | M | M | M | M | M | M | M | M | M | C | E |
| 180 | 181 | X | X | X | X | X | X | X | E | E | E | M | M | M | M | M | M | M | M | M | C | E |
| 220 | 221 | X | X | X | X | X | X | X | E | E | E | M | M | M | M | M | M | M | M | M | E | E |
| 270 | 271 | X | X | X | X | M | M | M | E | P | P | M | M | M | M | M | M | M | M | M | E | F |
| 330 | 331 | X | X | X | X | M | M | M | E | P | P | M | M | M | M | M | M | M | M | M | E | F |
| 390 | 391 | X | X | X | X | M | M | M | E | P | P | M | M | M | M | M | M | M | M | M | E | G |
| 470 | 471 | X | X | X | M | M | M | M | E | E | E | M | M | M | M | M | M | M | M | M | E | G |
| 560 | 561 | X | X | X | M | C | C | C | E | E | E | M | M | M | M | M | M | M | M | M | E | G |
| 680 | 681 | X | X | X | M | C | C | C | E | E | E | M | M | M | M | M | M | M | M | M | E | G |
| 820 | 821 | X | X | X | M | E | E | E | E | E | E | M | M | M | M | M | M | M | M | M | E | G |
| 1000 | 102 | X | X | X | M | E | E | E | E | E | E | M | M | M | C | C | C | C | C | E | G | G |
| 1200 | 122 | X | X | X | M | E | E | E | E | E | E | M | M | M | C | C | C | C | C | E | F | F |
| 1500 | 152 | X | X | X | C | E | E | E | E | E | E | M | M | M | C | C | C | C | C | F | G | G |
| 1800 | 182 | X | X | X | C | E | E | E | E | E | E | M | M | M | C | C | C | C | C | G | G | G |
| 2200 | 222 | X | X | X | C | E | E | E | E | E | E | M | M | M | C | C | C | C | C | G | | |
| 2700 | 272 | X | X | X | C | E | E | E | E | E | E | M | M | M | C | C | C | C | C | G | | |
| 3300 | 332 | X | X | X | C | E | E | E | E | E | E | M | M | M | C | C | C | C | C | G | | |
| 3900 | 392 | X | X | X | E | E | E | E | E | E | E | M | M | M | C | C | C | C | C | G | | |
| 4700 | 472 | X | X | X | E | E | E | E | E | E | E | M | M | M | E | E | E | E | E | | | |
| 5600 | 562 | X | X | X | E | E | E | E | E | E | E | M | M | C | E | E | E | E | E | | | |
| 6800 | 682 | M | M | M | E | E | E | E | E | E | E | M | M | C | E | E | E | E | E | | | |
| 8200 | 822 | C | C | C | E | E | E | E | E | E | E | M | M | C | E | E | E | E | E | | | |
| 10000 | 103 | C | C | C | E | E | E | E | E | E | E | M | M | E | F | F | F | F | F | | | |
| 12000 | 123 | P | P | P | | | | | | | | C | C | E | | | | | | | | |
| 15000 | 153 | P | P | P | | | | | | | | C | C | F | | | | | | | | |
| 18000 | 183 | P | P | P | | | | | | | | F | F | G | | | | | | | | |
| 22000 | 223 | P | P | P | | | | | | | | F | F | G | | | | | | | | |
| 27000 | 273 | P | P | | | | | | | | | G | G | | | | | | | | | |
| 33000 | 333 | P | P | | | | | | | | | G | G | | | | | | | | | |
| 39000 | 393 | P | P | | | | | | | | | G | G | | | | | | | | | |
| 47000 | 473 | | | | | | | | | | | | | | | | | | | | | |
| 56000 | 563 | | | | | | | | | | | | | | | | | | | | | |
| 68000 | 683 | | | | | | | | | | | | | | | | | | | | | |

7. CAPACITANCE RANGE(Con.)

7-1. C0G

| Dimension | | 1825 | | | | | | | | | | 2220 | | | | | | | | | | |
|-----------|------|------------|------|------|------|------|------|-------|-------|-------|-------|------------|------|------|------|------|------|-------|-------|-------|-------|-------|
| Cap.(pF) | Code | 25V 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 1500V | 2000V | 3000V | 25V 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 10 | 100 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 12 | 120 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 15 | 150 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 18 | 180 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 22 | 220 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 27 | 270 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 33 | 330 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 39 | 390 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 47 | 470 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 56 | 560 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 68 | 680 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 82 | 820 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 100 | 101 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 120 | 121 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 150 | 151 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 180 | 181 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 220 | 221 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 270 | 271 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | G |
| 330 | 331 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | G |
| 390 | 391 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 470 | 471 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 560 | 561 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 680 | 681 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 820 | 821 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 1000 | 102 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 1200 | 122 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 1500 | 152 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 1800 | 182 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 2200 | 222 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 2700 | 272 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 3300 | 332 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 3900 | 392 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 4700 | 472 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 5600 | 562 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 6800 | 682 | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 8200 | 822 | F | F | F | F | F | F | F | G | | F | F | F | F | F | F | G | | | | | |
| 10000 | 103 | F | F | F | F | F | F | G | | | F | F | F | F | F | F | G | | | | | |
| 12000 | 123 | F | F | F | F | F | F | | | | F | F | F | F | F | F | | | | | | |
| 15000 | 153 | F | F | F | F | F | F | | | | F | F | F | F | F | F | | | | | | |
| 18000 | 183 | F | F | F | F | F | F | | | | F | F | F | F | F | F | | | | | | |
| 22000 | 223 | F | F | F | F | F | F | | | | F | F | F | F | F | F | | | | | | |
| 27000 | 273 | F | F | F | F | F | | | | | F | F | F | F | F | | | | | | | |
| 33000 | 333 | F | F | F | F | F | | | | | F | F | F | F | F | | | | | | | |
| 39000 | 393 | F | E | F | F | G | | | | | F | F | F | F | F | | | | | | | |
| 47000 | 473 | F | E | F | F | G | | | | | F | F | G | G | G | | | | | | | |
| 56000 | 563 | F | F | G | G | | | | | | F | F | G | G | | | | | | | | |
| 68000 | 683 | F | F | G | G | | | | | | F | F | G | G | | | | | | | | |
| 82000 | 823 | F | G | | | | | | | | F | G | | | | | | | | | | |
| 100000 | 104 | G | G | | | | | | | | G | G | | | | | | | | | | |
| 120000 | 124 | | | | | | | | | | | | | | | | | | | | | |
| 150000 | 154 | | | | | | | | | | | | | | | | | | | | | |
| 180000 | 184 | | | | | | | | | | | | | | | | | | | | | |
| 220000 | 224 | | | | | | | | | | | | | | | | | | | | | |
| 270000 | 274 | | | | | | | | | | | | | | | | | | | | | |
| 330000 | 334 | | | | | | | | | | | | | | | | | | | | | |

7. CAPACITANCE RANGE(Con.)

7-1. C0G

| Dimension | | 2225 | | | | | | | | | | |
|-----------|------|------------|------|------|------|------|------|-------|-------|-------|-------|-------|
| Cap.(pF) | Code | 25V 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 10 | 100 | F | F | F | F | F | F | F | F | F | F | |
| 12 | 120 | F | F | F | F | F | F | F | F | F | F | |
| 15 | 150 | F | F | F | F | F | F | F | F | F | F | |
| 18 | 180 | F | F | F | F | F | F | F | F | F | F | |
| 22 | 220 | F | F | F | F | F | F | F | F | F | F | |
| 27 | 270 | F | F | F | F | F | F | F | F | F | F | F |
| 33 | 330 | F | F | F | F | F | F | F | F | F | F | F |
| 39 | 390 | F | F | F | F | F | F | F | F | F | F | F |
| 47 | 470 | F | F | F | F | F | F | F | F | F | F | F |
| 56 | 560 | F | F | F | F | F | F | F | F | F | F | F |
| 68 | 680 | F | F | F | F | F | F | F | F | F | F | F |
| 82 | 820 | F | F | F | F | F | F | F | F | F | F | F |
| 100 | 101 | F | F | F | F | F | F | F | F | F | F | F |
| 120 | 121 | F | F | F | F | F | F | F | F | F | F | |
| 150 | 151 | F | F | F | F | F | F | F | F | F | F | |
| 180 | 181 | F | F | F | F | F | F | F | F | F | F | |
| 220 | 221 | F | F | F | F | F | F | F | F | F | F | |
| 270 | 271 | F | F | F | F | F | F | F | F | F | F | |
| 330 | 331 | F | F | F | F | F | F | F | F | F | F | |
| 390 | 391 | F | F | F | F | F | F | F | F | F | F | |
| 470 | 471 | F | F | F | F | F | F | F | F | F | F | |
| 560 | 561 | F | F | F | F | F | F | F | F | F | F | |
| 680 | 681 | F | F | F | F | F | F | F | F | F | F | |
| 820 | 821 | F | F | F | F | F | F | F | F | F | F | |
| 1000 | 102 | F | F | F | F | F | F | F | F | F | F | |
| 1200 | 122 | F | F | F | F | F | F | F | F | F | F | |
| 1500 | 152 | F | F | F | F | F | F | F | F | F | F | |
| 1800 | 182 | F | F | F | F | F | F | F | F | F | F | |
| 2200 | 222 | F | F | F | F | F | F | F | F | F | F | |
| 2700 | 272 | F | F | F | F | F | F | F | F | F | G | |
| 3300 | 332 | F | F | F | F | F | F | F | F | F | G | |
| 3900 | 392 | F | F | F | F | F | F | F | F | F | | |
| 4700 | 472 | F | F | F | F | F | F | F | F | F | | |
| 5600 | 562 | F | F | F | F | F | F | F | F | F | | |
| 6800 | 682 | F | F | F | F | F | F | F | F | F | | |
| 8200 | 822 | F | F | F | F | F | F | F | G | G | | |
| 10000 | 103 | F | F | F | F | F | F | G | G | G | | |
| 12000 | 123 | F | F | F | F | F | F | | | | | |
| 15000 | 153 | F | F | F | F | F | F | | | | | |
| 18000 | 183 | F | F | F | F | F | F | | | | | |
| 22000 | 223 | F | F | F | F | F | F | | | | | |
| 27000 | 273 | F | F | F | F | F | F | | | | | |
| 33000 | 333 | F | F | F | F | F | F | | | | | |
| 39000 | 393 | F | F | F | F | F | F | | | | | |
| 47000 | 473 | F | F | F | F | F | F | | | | | |
| 56000 | 563 | F | F | G | G | G | G | | | | | |
| 68000 | 683 | F | F | G | G | G | G | | | | | |
| 82000 | 823 | F | F | G | G | G | | | | | | |
| 100000 | 104 | F | G | G | G | | | | | | | |
| 120000 | 124 | | | | | | | | | | | |
| 150000 | 154 | | | | | | | | | | | |
| 180000 | 184 | | | | | | | | | | | |
| 220000 | 224 | | | | | | | | | | | |
| 270000 | 274 | | | | | | | | | | | |
| 330000 | 334 | | | | | | | | | | | |

7. CAPACITANCE RANGE(Con.)

7-2. X7R

| Dimension | | 2225 | | | | | | | | | | | |
|-----------|------|------|-----|------|------|------|------|------|-------|-------|-------|-------|-------|
| Cap.(pF) | Code | 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 100 | 101 | | | | | | | | | | | | |
| 120 | 121 | | | | | | | | | | | | |
| 150 | 151 | | | | | | | | | | | | |
| 180 | 181 | | | | | | | | | | | | |
| 220 | 221 | | | | | | | | | | | | |
| 270 | 271 | | | | | | | | | | | | F* |
| 330 | 331 | | | | | | | | | | | | F* |
| 390 | 391 | | | | | | | | | | | | F* |
| 470 | 471 | | | | | | | | | | | | F* |
| 560 | 561 | | | | | | | | | | | | F* |
| 680 | 681 | | | | | | | | | | | | F* |
| 820 | 821 | | | | | | | | | | | | F* |
| 1000 | 102 | F | F | F | F | F | F | F | F | F | F | F* | F* |
| 1200 | 122 | F | F | F | F | F | F | F | F | F | F | F* | G* |
| 1500 | 152 | F | F | F | F | F | F | F | F | F | F | F* | G* |
| 1800 | 182 | F | F | F | F | F | F | F | F | F | F | F* | G* |
| 2200 | 222 | F | F | F | F | F | F | F | F | F | F | F* | |
| 2700 | 272 | F | F | F | F | F | F | F | F | F | F | F* | |
| 3300 | 332 | F | F | F | F | F | F | F | F | F | F | F* | |
| 3900 | 392 | F | F | F | F | F | F | F | F | F | F | F* | |
| 4700 | 472 | F | F | F | F | F | F | F | F | F | F | F* | |
| 5600 | 562 | F | F | F | F | F | F | F | F | F | F | G* | |
| 6800 | 682 | F | F | F | F | F | F | F | F | F | F | G* | |
| 8200 | 822 | F | F | F | F | F | F | F | F | F | F | G* | |
| 10000 | 103 | F | F | F | F | F | F | F | F | F | F | G* | |
| 12000 | 123 | F | F | F | F | F | F | F | F | G | G | G* | |
| 15000 | 153 | F | F | F | F | F | F | F | F | G | G | G* | |
| 18000 | 183 | F | F | F | F | F | F | F | F | G | G | H* | |
| 22000 | 223 | F | F | F | F | F | F | F | F | F/G | F/G | | |
| 27000 | 273 | F | F | F | F | F | F | F | F | G | G | | |
| 33000 | 333 | F | F | F | F | F | F | F | F | G | G | | |
| 39000 | 393 | F | F | F | F | F | F | F | F | G | H | | |
| 47000 | 473 | F | F | F | F | F | F | F | F | G | H | | |
| 56000 | 563 | F | F | F | F | F | F | F | F | G | H | | |
| 68000 | 683 | F | F | F | F | F | F | F | F | G | | | |
| 82000 | 823 | F | F | F | F | F | F | F | F | G | | | |
| 100000 | 104 | F | F | F | F | F | F | F | G | G | | | |
| 120000 | 124 | F | F | F | F | F | F | F | H | | | | |
| 150000 | 154 | F | F | F | F | F | F | F | H | | | | |
| 180000 | 184 | F | F | F | F | F | F | F | H | | | | |
| 220000 | 224 | F | F | F | F | F | F | F | H | | | | |
| 270000 | 274 | F | F | F | F | F | F | F | | | | | |
| 330000 | 334 | F | F | F | F | F | F | F | | | | | |
| 390000 | 394 | F | F | F | F | F | F | F | | | | | |
| 470000 | 474 | F | F | F | F | F | F | F | | | | | |
| 560000 | 564 | F | F | F | F | F | F | F | | | | | |
| 680000 | 684 | F | F | F | F | F | F | F | | | | | |
| 820000 | 824 | F | F | F | F | F | F | F | | | | | |
| 1000000 | 105 | F | F | F | F | F | F | F | | | | | |
| 1200000 | 125 | F | F | F | G | G | | | | | | | |
| 1500000 | 155 | F | F | F | G | G | | | | | | | |
| 1800000 | 185 | F | F | F | G | G | | | | | | | |
| 2200000 | 225 | F | F | F | G | G | | | | | | | |
| 2700000 | 275 | F | F | F | G | G | | | | | | | |
| 3300000 | 335 | F | F | F | | | | | | | | | |
| 3900000 | 395 | F | F | F | | | | | | | | | |
| 4700000 | 475 | F | F | F | | | | | | | | | |
| 5600000 | 565 | F | F | F | | | | | | | | | |
| 6800000 | 685 | F | F | F | | | | | | | | | |
| 8200000 | 825 | G | G | G | | | | | | | | | |
| 10000000 | 106 | G | G | G | | | | | | | | | |
| 12000000 | 126 | | | | | | | | | | | | |
| 15000000 | 156 | | | | | | | | | | | | |
| 18000000 | 186 | | | | | | | | | | | | |
| 22000000 | 226 | | | | | | | | | | | | |

* Surface coating only.

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|-----------------------|--|---|--|---------------|-----------------|--------|-------------------|-----|-------------------|-----------|------------|-----------|-------|------------|--------------------|----------------|-------|----------|-------|---|------------|--|----------|-------------------------|---------------|-------|-----------|--|------|-------------------------|------|---|------|------------|------|---|-----------|----------------------------------|-----------|-------------------------|-----------|-------|-----------|---|--------|-----------------|------|---|------|---|------|---|------|--|------|----------------------|-----|-----|------|--|------|------------|-----|-----|------|------|------|--|------|------------|-----|-----|----|------|-----|-----|
| 1. | Visual and Dimensions | --- | * No remarkable defect. * Dimensions to confirm to individual specification sheet. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | Capacitance | * Class I : Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%. * Class II : Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**. Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%. ** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V,10V,16V)#1, 0402 ≥ 475 (6.3V,16V), 0402 ≥ 225(10V), 0603=106 (6.3V) TT18X ≥ 475(10V) , TT15X series X6S: 0201/474(4V),0201 ≥ 104 (6.3V,10V#1), 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V) #1 Excluding X5R/0201/105(6.3V);225(10V), X6S/0201/104(10V) (1.0±0.2Vrms · 1KHz±10%) | * Shall not exceed the limits given in the detailed spec. * Class I : <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Rated Vol.(V)</th> <th>Q/D.F.</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Class I</td> <td rowspan="2">All</td> <td>Q≥1000</td> <td>Cap.≥30pF</td> </tr> <tr> <td>Q≥400+20C</td> <td>Cap.<30pF</td> </tr> </tbody> </table> * Class II : <table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td rowspan="3">≤2.5%</td> <td>≤3.5%</td> <td>0603≥0.047μF, 0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td> </tr> <tr> <td>≤5%</td> <td>0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤10%</td> <td>0805>0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤2.5%</td> <td>≤3.5%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤3.5%</td> <td>≤10%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF, 1206≥4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤3.5%</td> <td>≤10%</td> <td>0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤3.5%</td> <td>≤10%</td> <td>0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤5%</td> <td>≤10%</td> <td>0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥2.2μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤10%</td> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥2.2μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Dielectric | Rated Vol.(V) | Q/D.F. | Remark | Class I | All | Q≥1000 | Cap.≥30pF | Q≥400+20C | Cap.<30pF | Rated | D.F.≤ | Exception of D.F.≤ | | ≥100V | ≤2.5% | ≤3.5% | 0603≥0.047μF, 0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF | ≤5% | 0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF | ≤10% | 0805>0.22μF, 1210≥3.3μF | 50V | ≤2.5% | ≤3.5% | 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF | ≤5% | 0201≥0.01μF, 1210≥4.7μF | ≤10% | 0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF | 35V | ≤3.5% | ≤10% | 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | ≤5% | 0201≥0.01μF, 0805≥1μF, 1210≥10μF | ≤7% | 0603≥0.33μF, 1206≥4.7μF | 25V | ≤3.5% | ≤10% | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF | ≤12.5% | 0402≥0.47μF | ≤5% | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF | 16V | ≤3.5% | ≤10% | 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF | ≤10% | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF | ≤15% | 0201≥0.1μF, 0402≥1μF | 10V | ≤5% | ≤10% | 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF | ≤20% | 0402≥2.2μF | --- | --- | 6.3V | ≤10% | ≤15% | 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF | ≤20% | 0402≥2.2μF | --- | --- | 4V | ≤15% | --- | --- |
| Dielectric | Rated Vol.(V) | Q/D.F. | Remark | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Class I | All | Q≥1000 | Cap.≥30pF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Q≥400+20C | Cap.<30pF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated | D.F.≤ | Exception of D.F.≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥100V | ≤2.5% | ≤3.5% | 0603≥0.047μF, 0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤5% | 0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0805>0.22μF, 1210≥3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V | ≤2.5% | ≤3.5% | 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤5% | 0201≥0.01μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | ≤3.5% | ≤10% | 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤5% | 0201≥0.01μF, 0805≥1μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤7% | 0603≥0.33μF, 1206≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤3.5% | ≤10% | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤12.5% | 0402≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤5% | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤3.5% | ≤10% | 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤15% | 0201≥0.1μF, 0402≥1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤5% | ≤10% | 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤20% | 0402≥2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤10% | ≤15% | 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤20% | 0402≥2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤15% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 3. | Q/D.F. (Dissipation Factor) | * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4. | Temperature Coefficient | * With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp.</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> </tbody> </table> * Measurement voltage for Class II : <table border="1"> <thead> <tr> <th>Size</th> <th>Cap. Range</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td rowspan="3">0201</td> <td>Cap.<0.1μF</td> <td>1V</td> </tr> <tr> <td>0.1μF≤Cap.<1μF</td> <td>0.2V</td> </tr> <tr> <td>Cap.≥1μF</td> <td>0.1V</td> </tr> <tr> <td rowspan="4">0402</td> <td>Cap.<0.1μF</td> <td>1V</td> </tr> <tr> <td>Cap.=1μF</td> <td>0.5V</td> </tr> <tr> <td>1μF<Cap.<10μF</td> <td>0.2V</td> </tr> <tr> <td>Cap.≥10μF</td> <td>0.1V</td> </tr> <tr> <td rowspan="3">0603</td> <td>Cap.≤1μF</td> <td>1V</td> </tr> <tr> <td>1μF<Cap.≤4.7μF</td> <td>0.5V</td> </tr> <tr> <td>Cap.>4.7μF</td> <td>0.2V</td> </tr> <tr> <td rowspan="3">0805</td> <td>Cap.<10μF</td> <td>1V</td> </tr> <tr> <td>Cap.=10μF</td> <td>0.5V</td> </tr> <tr> <td>Cap.>10μF</td> <td>0.2V</td> </tr> <tr> <td rowspan="4">1206/1210</td> <td>Cap.≤10μF</td> <td>1V</td> </tr> <tr> <td>10μF<Cap.≤100μF</td> <td>0.5V</td> </tr> <tr> <td>Cap.>100μF</td> <td>0.2V</td> </tr> </tbody> </table> | T.C. | Operating Temp. | C0G | -55~125°C at 25°C | X7R | -55~125°C at 25°C | Size | Cap. Range | Condition | 0201 | Cap.<0.1μF | 1V | 0.1μF≤Cap.<1μF | 0.2V | Cap.≥1μF | 0.1V | 0402 | Cap.<0.1μF | 1V | Cap.=1μF | 0.5V | 1μF<Cap.<10μF | 0.2V | Cap.≥10μF | 0.1V | 0603 | Cap.≤1μF | 1V | 1μF<Cap.≤4.7μF | 0.5V | Cap.>4.7μF | 0.2V | 0805 | Cap.<10μF | 1V | Cap.=10μF | 0.5V | Cap.>10μF | 0.2V | 1206/1210 | Cap.≤10μF | 1V | 10μF<Cap.≤100μF | 0.5V | Cap.>100μF | 0.2V | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> </tbody> </table> | T.C. | Capacitance Change | C0G | Within ±30ppm/°C | X7R | Within ±15% | | | | | | | | | | | | | | | | | | | | |
| T.C. | Operating Temp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C0G | -55~125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | -55~125°C at 25°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size | Cap. Range | Condition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0201 | Cap.<0.1μF | 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.1μF≤Cap.<1μF | 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.≥1μF | 0.1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | Cap.<0.1μF | 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.=1μF | 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1μF<Cap.<10μF | 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.≥10μF | 0.1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | Cap.≤1μF | 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1μF<Cap.≤4.7μF | 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.>4.7μF | 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | Cap.<10μF | 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.=10μF | 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.>10μF | 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206/1210 | Cap.≤10μF | 1V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10μF<Cap.≤100μF | 0.5V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cap.>100μF | 0.2V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | T.C. | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C0G | Within ±30ppm/°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--|--|---------------|-------------|-----------------------------|----------------------------|-----------------------------|-----------|-----------------------------|-------------|-----------------------------|----------------------------|-----------------------------|---|-----------------------------|--|--|---|----------|---|---------------------|------|-----------------|---|---|---|--|---|--|----------|---------------------|------|-------------------|-----------|--|----------------|---|--|--|---|---------------------------------------|
| 5. | Insulation Resistance | <table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Apply Voltage</th> <th>Charge Time</th> </tr> </thead> <tbody> <tr> <td>≤100</td> <td>1 times of U_R</td> <td>Max. 120 sec.</td> </tr> <tr> <td>200≤V≤500</td> <td>1 times of U_R</td> <td>60 sec.</td> </tr> <tr> <td>>500</td> <td>500Vdc</td> <td>60 sec.</td> </tr> </tbody> </table> | Rated Vol.(V) | Apply Voltage | Charge Time | ≤100 | 1 times of U _R | Max. 120 sec. | 200≤V≤500 | 1 times of U _R | 60 sec. | >500 | 500Vdc | 60 sec. | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>Class I</td> <td>≥10GΩ or RxC≥500Ω-F, whichever is smaller</td> </tr> <tr> <td>Class II</td> <td>≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> </tbody> </table> <p>* Except (Class II) :</p> <table border="1"> <thead> <tr> <th>Rated voltage (X7R)</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="10">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF, 1812≥10μF, 2220≥22μF</td> </tr> <tr> <td>35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V; 4V</td> </tr> <tr> <th>Rated voltage (X7R)</th> <th>I.R.</th> </tr> <tr> <td>100V : 1210≥3.3μF</td> <td rowspan="8">RxC≥50Ω-F</td> </tr> <tr> <td>50V : 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF</td> </tr> <tr> <td>35V : 0603≥1μF</td> </tr> <tr> <td>25V : 0201≥0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF</td> </tr> <tr> <td>16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF</td> </tr> <tr> <td>10V : 0201>0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF</td> </tr> <tr> <td>6.3V : 0201≥0.1μF, 0603>4.7μF, 0805≥47μF, 1206≥10μF</td> </tr> <tr> <td>4V : 0603≥22μF, 0805≥47μF, 1206≥100μF</td> </tr> </tbody> </table> | Dielectric | Capacitance Change | Class I | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | Class II | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | Rated voltage (X7R) | I.R. | ≥100V : All X7R | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF, 1812≥10μF, 2220≥22μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | 16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | 6.3V; 4V | Rated voltage (X7R) | I.R. | 100V : 1210≥3.3μF | RxC≥50Ω-F | 50V : 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF | 35V : 0603≥1μF | 25V : 0201≥0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF | 16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF | 10V : 0201>0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF | 6.3V : 0201≥0.1μF, 0603>4.7μF, 0805≥47μF, 1206≥10μF | 4V : 0603≥22μF, 0805≥47μF, 1206≥100μF |
| | | | Rated Vol.(V) | Apply Voltage | Charge Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤100 | 1 times of U _R | Max. 120 sec. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200≤V≤500 | 1 times of U _R | 60 sec. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >500 | 500Vdc | 60 sec. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dielectric | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Class I | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Class II | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage (X7R) | I.R. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥100V : All X7R | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF, 1812≥10μF, 2220≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V; 4V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage (X7R) | | I.R. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V : 1210≥3.3μF | | RxC≥50Ω-F | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0603≥1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0201≥0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V : 0201>0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V : 0201≥0.1μF, 0603>4.7μF, 0805≥47μF, 1206≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V : 0603≥22μF, 0805≥47μF, 1206≥100μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | Dielectric Strength | <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>≤100</td> <td>2.5 times of U_R</td> </tr> <tr> <td>100<V≤250</td> <td>2.0 times of U_R</td> </tr> <tr> <td>250<V≤500</td> <td>1.5 times of U_R</td> </tr> <tr> <td>630≤V≤3000V</td> <td>1.2 times of U_R</td> </tr> <tr> <td>3000<V<5000V</td> <td>1.1 times of U_R</td> </tr> <tr> <td>≥5000V</td> <td>1.0 times of U_R</td> </tr> </tbody> </table> <p>* Duration : 1 to 5 sec. Voltage ramp up rate ≤500Vdc/sec. * Charge and discharge current less than 50mA. * Test in insulating fluid for rated voltage ≥1KV products.</p> | Rated Voltage | Condition | ≤100 | 2.5 times of U _R | 100<V≤250 | 2.0 times of U _R | 250<V≤500 | 1.5 times of U _R | 630≤V≤3000V | 1.2 times of U _R | 3000<V<5000V | 1.1 times of U _R | ≥5000V | 1.0 times of U _R | * No evidence of damage or flash over during test. | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated Voltage | Condition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤100 | 2.5 times of U _R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100<V≤250 | 2.0 times of U _R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 250<V≤500 | 1.5 times of U _R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 630≤V≤3000V | 1.2 times of U _R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3000<V<5000V | 1.1 times of U _R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥5000V | 1.0 times of U _R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | Solderability | <p>* Solder temperature : 235±5°C for (0402~1210). * Solder temperature : 245±5°C for (1808~2225). * Dipping time : 2±0.5 sec.</p> | * 75% min. coverage of all metalized area. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8. | Resistance to Soldering Heat | <p>* Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p> | <p>* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * D.F./Q, I.R : To meet initial requirements. * 25% max. leaching on each edge.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. | Temperature Cycle | <p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> <p>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p> | Step | Temp.(°C) | Time(min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | <p>* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * D.F./Q : C0G : Q≥100% of initial requirements. X7R : D.F.≤150% of initial requirement. * I.R. : ≥100% of initial requirement.</p> | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temp.(°C) | Time(min.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Min. operating temp. +0/-3 | 30±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Max. operating temp. +3/-0 | 30±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

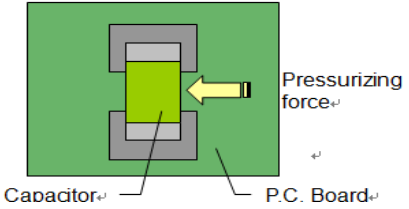
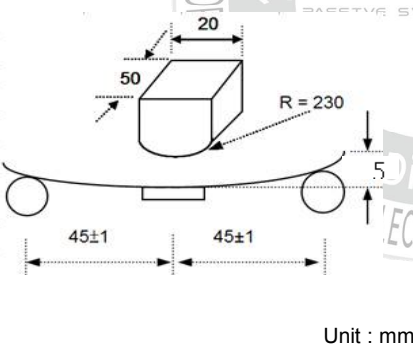
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | |
|--|--|--|---|---------------|------|-----------------------------|--|---|---|---|---|--|---------------------|--|
| 10. | Humidity (Damp Heat) Steady State | * Test temp. : 40±2°C. * Humidity : 90~95%RH. * Test time : 500 +24/-0hrs. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II). | * No remarkable damage. * Cap. change : COG : Within ±5.0% or ±0.5pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : COG : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Except : <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V : All X7R; 1210≥3.3μF</td> <td rowspan="6">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td colspan="2">6.3V; 4V; Size≥1812</td> </tr> </tbody> </table> | Rated voltage | I.R. | 100V : All X7R; 1210≥3.3μF | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | 16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | 6.3V; 4V; Size≥1812 | |
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| 6.3V; 4V; Size≥1812 | | | | | | | | | | | | | | |
| 11. | Humidity (Damp Heat) Load | * Reflow solder the capacitors on a P.C. Board before test. * Test temp. : 40±2°C (85±3°C for control code H). * Humidity : 90~95% RH (85±5% for control code H). * Test time : 500 +24/-0hrs. * To apply voltage : Rated voltage (500Vdc max. for general purpose and 100Vdc max. for control code H) * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II). | * No remarkable damage. * Cap. change : COG : Within ±7.5% or ±0.75pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : COG : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : ≤200% of initial requirement. * I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller. Except : <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R; 1210≥3.3μF</td> <td rowspan="6">≥500MΩ or RxC≥5Ω-F, whichever is smaller</td> </tr> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td colspan="2">6.3V; 4V; Size≥1812</td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R; 1210≥3.3μF | ≥500MΩ or RxC≥5Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | 16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | 6.3V; 4V; Size≥1812 | |
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| 6.3V; 4V; Size≥1812 | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|--------------|------------|-------|-------------|------|-----|------|---------|------|---------|------|-----|---------------------|---------|----|--------|----------|---------|------|-----|----------|---------|----|--------|------|--------|------|-----|---------|--------|-------|--------|------|---------|------|-----|-----|--------|-------|---------|------|-----|------|--------|------|------------|---------------|-------------|------|-----|-----|-----------|-----|---------|------|-----|--------|----------|------|-----------|------|-----|--------------|---------|--------|---------|------|-----|-----|----------|-------|----------|------|-----|------|---------|-------|---------|------|-----|-------|----------|------|---------|------|-----|------|---------|-------|---------|------|-----|-------|---------|------|------|------|------------|---------------|-------------|------|-----|-------|--------|---|---------------|------|----------------------------|---|---|---|---|---|--|---------------------|
| 12. | High Temperature Load (Endurance) | <p>* Test temp. : 125±3°C.</p> <p>* To apply voltage :</p> <p>(1) ≤6.3V or Cap.≥10μF : 150% of rated voltage.</p> <p>(2) 10V≤Ur≤100V : 200% of rated voltage.</p> <p>(3) 200V≤Ur≤500V : 150% of rated voltage.</p> <p>(4) 630V : 120% of rated voltage.</p> <p>(5) Ur≥1000V : 100% of rated voltage.</p> <p>(6) 100% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X7R</td> <td>≤10V</td> <td>C≥0.1μF</td> </tr> <tr> <td>≥16V</td> <td>C>0.1μF</td> </tr> <tr> <td rowspan="3">0402</td> <td rowspan="3">X7R</td> <td>6.3V, 10V, 16V, 25V</td> <td>C≥1.0μF</td> </tr> <tr> <td>4V</td> <td>C≥22μF</td> </tr> <tr> <td>6.3V,10V</td> <td>C≥4.7μF</td> </tr> <tr> <td rowspan="3">0603</td> <td rowspan="3">X7R</td> <td>25V, 35V</td> <td>C≥1.0μF</td> </tr> <tr> <td>4V</td> <td>C≥47μF</td> </tr> <tr> <td>6.3V</td> <td>C≥22μF</td> </tr> <tr> <td rowspan="3">0805</td> <td rowspan="3">X7R</td> <td>10V~50V</td> <td>C≥10μF</td> </tr> <tr> <td>≤6.3V</td> <td>C≥47μF</td> </tr> <tr> <td>100V</td> <td>C≥2.2μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X7R</td> <td>16V</td> <td>C≥47μF</td> </tr> <tr> <td>≥100V</td> <td>C≥3.3μF</td> </tr> <tr> <td>2220</td> <td>X7R</td> <td>100V</td> <td>C≥22μF</td> </tr> </tbody> </table> <p>(7) 150% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X7R</td> <td>16V</td> <td>C≥0.022μF</td> </tr> <tr> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X7R</td> <td>10~25V</td> <td>C≥0.22μF</td> </tr> <tr> <td>≥50V</td> <td>C≥0.082μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X7R</td> <td>10V,16V, 50V</td> <td>C≥1.0μF</td> </tr> <tr> <td>10~50V</td> <td>C≥4.7μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X7R</td> <td>50V</td> <td>C≥0.47μF</td> </tr> <tr> <td>≥100V</td> <td>C≥0.12μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X7R</td> <td>≥50V</td> <td>C≥1.0μF</td> </tr> <tr> <td>≤100V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X7R</td> <td>>100V</td> <td>C≥0.22μF</td> </tr> <tr> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td rowspan="2">1812</td> <td rowspan="2">X7R</td> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>≥100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>1825</td> <td rowspan="2">X7R</td> <td rowspan="2">≥100V</td> <td rowspan="2">C≥1.0μF</td> </tr> <tr> <td>2220</td> </tr> <tr> <td>2225</td> </tr> </tbody> </table> <p>(8) 120% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td>2220</td> <td>X7R</td> <td>≥100V</td> <td>C≥15μF</td> </tr> </tbody> </table> <p>* Test time : 1000 +24/-0 hrs.</p> <p>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).</p> <p>** De-rating conditions :</p> | Size | Dielectric | Rated | Capacitance | 0201 | X7R | ≤10V | C≥0.1μF | ≥16V | C>0.1μF | 0402 | X7R | 6.3V, 10V, 16V, 25V | C≥1.0μF | 4V | C≥22μF | 6.3V,10V | C≥4.7μF | 0603 | X7R | 25V, 35V | C≥1.0μF | 4V | C≥47μF | 6.3V | C≥22μF | 0805 | X7R | 10V~50V | C≥10μF | ≤6.3V | C≥47μF | 100V | C≥2.2μF | 1206 | X7R | 16V | C≥47μF | ≥100V | C≥3.3μF | 2220 | X7R | 100V | C≥22μF | Size | Dielectric | Rated Voltage | Capacitance | 0201 | X7R | 16V | C≥0.022μF | 50V | C≥0.1μF | 0402 | X7R | 10~25V | C≥0.22μF | ≥50V | C≥0.082μF | 0603 | X7R | 10V,16V, 50V | C≥1.0μF | 10~50V | C≥4.7μF | 0805 | X7R | 50V | C≥0.47μF | ≥100V | C≥0.12μF | 1206 | X7R | ≥50V | C≥1.0μF | ≤100V | C≥1.0μF | 1210 | X7R | >100V | C≥0.22μF | ≤50V | C≥4.7μF | 1812 | X7R | 100V | C≥1.0μF | ≥100V | C≥1.0μF | 1825 | X7R | ≥100V | C≥1.0μF | 2220 | 2225 | Size | Dielectric | Rated Voltage | Capacitance | 2220 | X7R | ≥100V | C≥15μF | <p>* No remarkable damage.</p> <p>* Cap. change :</p> <p>C0G : Within ±5.0% or ±0.5pF, whichever is larger.</p> <p>X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V.</p> <p>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF.</p> <p>* D.F./Q :</p> <p>C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF.</p> <p>X7R : D.F.≤200% of initial requirement.</p> <p>* I.R. : ≥10V, ≥1GΩ or R×C≥50Ω-F, whichever is smaller.</p> <p>Except :</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V : All X7R; 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| Size | Dielectric | Rated | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0201 | X7R | ≤10V | C≥0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥16V | C>0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | X7R | 6.3V, 10V, 16V, 25V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4V | C≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 6.3V,10V | C≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | X7R | 25V, 35V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4V | C≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 6.3V | C≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X7R | 10V~50V | C≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤6.3V | C≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | C≥2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206 | X7R | 16V | C≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥100V | C≥3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2220 | X7R | 100V | C≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size | Dielectric | Rated Voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0201 | X7R | 16V | C≥0.022μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C≥0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0402 | X7R | 10~25V | C≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥50V | C≥0.082μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0603 | X7R | 10V,16V, 50V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10~50V | C≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X7R | 50V | C≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥100V | C≥0.12μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206 | X7R | ≥50V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤100V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1210 | X7R | >100V | C≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤50V | C≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1812 | X7R | 100V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥100V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1825 | X7R | ≥100V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2220 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2225 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size | Dielectric | Rated Voltage | Capacitance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2220 | X7R | ≥100V | C≥15μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | I.R. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100V : All X7R; 1210≥3.3μF | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V; 4V; Size≥1812 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | |
|----------------|--|---|---|------------|-------------|---------------|--|----------------|---------------------|
| 13. | Adhesive Strength of Termination | <p>* Capacitors mounted on a substrate. A force of 5N(≤ 0603) or 10N(>0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 second.</p>  | <p>* No remarkable damage or removal of the terminations.</p> | | | | | | |
| 14. | Bending Test | <p>* 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 5mm for product size < 1808, 3mm for product size ≥ 1808.</p>  | <p>* No remarkable damage.</p> <table border="1" data-bbox="798 1048 1492 1146"> <thead> <tr> <th>Dielectric</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td>Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$, whichever is larger</td> </tr> <tr> <td>Class II (X7R)</td> <td>Within $\pm 12.5\%$</td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p> | Dielectric | Cap. Change | Class I (C0G) | Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$, whichever is larger | Class II (X7R) | Within $\pm 12.5\%$ |
| Dielectric | Cap. Change | | | | | | | | |
| Class I (C0G) | Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$, whichever is larger | | | | | | | | |
| Class II (X7R) | Within $\pm 12.5\%$ | | | | | | | | |
| 15. | Vibration Resistance | <p>* Vibration frequency : 10~55 Hz/min. * Total amplitude : 1.5mm. * Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions) * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</p> | <p>* No remarkable damage. * Cap. change and D.F./Q : To meet initial spec.</p> | | | | | | |

9. PACKAGE DIMENSION AND QUANTITY

| Size | Thickness (mm) | Paper tape | | Plastic tape | |
|------------|------------------|------------|----------|--------------|----------|
| | | 7" reel | 13" reel | 7" reel | 13" reel |
| 0402(1005) | 0.50±0.05 | 10k | 50k | - | - |
| | 0.50 +0.02/-0.05 | 10k | 50k | - | - |
| | 0.50±0.20 | 10k | - | - | - |
| 0603(1608) | 0.50±0.10 | 4k | - | - | - |
| | 0.80±0.07 | 4k | 15k | - | - |
| | 0.80 +0.15/-0.10 | 4k | 15k | - | - |
| 0805(2012) | 0.50±0.10 | 4k | 15k | - | - |
| | 0.60±0.10 | 4k | 15k | - | - |
| | 0.80±0.10 | 4k | 15k | - | - |
| | 0.85±0.10 | 4k | 15k | - | - |
| | 1.25±0.10 | - | - | 3k | 10k |
| 1206(3216) | 1.25±0.20 | - | - | 3k | 10k |
| | 0.80±0.10 | 4k | 15k | - | - |
| | 0.85±0.10 | 4k | 15k | - | - |
| | 0.95±0.10 | - | - | 3k | 10k |
| | 1.15±0.15 | - | - | 3k | 10k |
| | 1.25±0.10 | - | - | 3k | 10k |
| | 1.60±0.20 | - | - | 2k | 10k |
| 1210(3225) | 1.60 +0.30/-0.10 | - | - | 2k | 9k |
| | 0.85±0.10 | - | - | 3k | 10k |
| | 0.95±0.10 | - | - | 3k | 10k |
| | 1.25±0.10 | - | - | 3k | 10k |
| | 1.60±0.20 | - | - | 2k | - |
| | 2.00±0.20 | - | - | 1k | 6k |
| 1808(4520) | 2.50±0.30 | - | - | 1k | 6k |
| | 1.25±0.10 | - | - | 2k | 10k |
| | 1.60±0.20 | - | - | 2k | 8k |
| 1812(4532) | 2.00±0.20 | - | - | 1k | 6k |
| | 1.25±0.10 | - | - | 1k | 5k |
| | 1.60±0.20 | - | - | 1k | - |
| | 2.00±0.20 | - | - | 1k | - |
| | 2.50±0.30 | - | - | 0.5k | 3k |
| 1825(4563) | 2.80±0.30 | - | - | 0.5k | - |
| | 1.60±0.20 | - | - | 1k | - |
| | 2.00±0.20 | - | - | 1k | - |
| | 2.50±0.30 | - | - | 0.5k | - |
| 2220(5750) | 2.80±0.30 | - | - | 0.5k | - |
| | 1.60±0.20 | - | - | 1k | - |
| | 2.00±0.20 | - | - | 1k | - |
| 2225(5763) | 2.50±0.30 | - | - | 0.5k | - |
| | 2.80±0.30 | - | - | 0.5k | - |
| | 1.60±0.20 | - | - | 1k | - |

Unit : pcs

9. PACKAGE DIMENSION AND QUANTITY

9.1. EMBOSSED TAPE DIMENSIONS

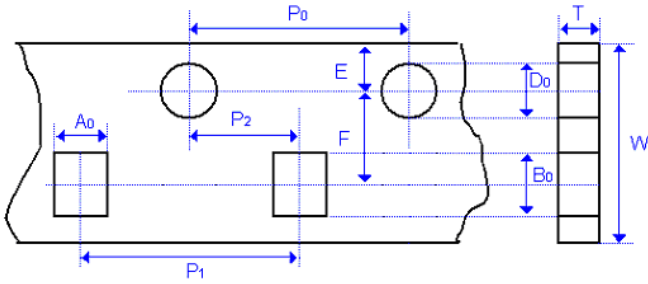


Fig. 9.1 The dimension of paper tape

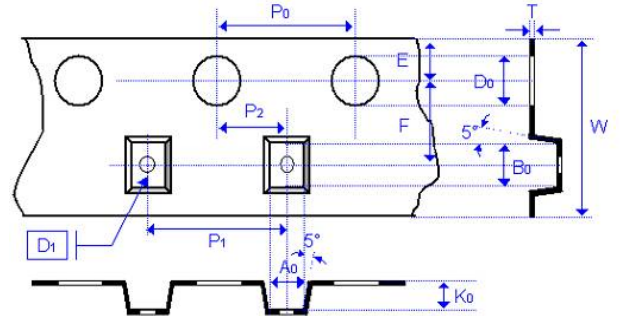


Fig. 9.2 The dimension of plastic tape

| Size | 0402 | | 0603 | | 0805 | |
|-------------------|------------|------------|-----------------|-----------------|------------|------------------------|
| Chip Thickness | 0.50±0.05 | 0.50±0.10 | 0.80±0.07 | 0.80 +0.15/-0.1 | 0.80±0.10 | 1.25±0.10 1.25±0.20 |
| A ₀ | 0.70±0.20 | 0.70±0.20 | 1.00 +0.05/-0.1 | 1.02 +0.05/-0.1 | 1.50±0.10 | <1.65 |
| B ₀ | 1.20±0.20 | 1.20±0.20 | 1.80±0.10 | 1.80±0.10 | 2.30±0.10 | <2.40 |
| T | ≤0.80 | ≤0.80 | 0.95±0.05 | 0.97±0.05 | 0.95±0.05 | 0.23±0.05 |
| K ₀ | - | - | - | - | - | <2.50 |
| 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 ₀ | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |
| 10xP ₀ | 40.00±0.10 | 40.00±0.10 | 40.00±0.20 | 40.00±0.20 | 40.00±0.20 | 40.00±0.20 |
| P ₁ | 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 ₂ | 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 ₀ | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.55±0.05 | 1.50 +0.10/-0 |
| D ₁ | - | - | - | - | - | 1.00±0.10 |
| 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 |
| Unit : | mm | mm | mm | mm | mm | mm |

| Size | 1206 | | | 1210 | | 1808 | |
|-------------------|------------|------------------------|------------------------|------------------------|---------------|------------------------|--------------|
| Chip Thickness | 0.80±0.10 | 0.95±0.10 1.25±0.10 | 1.25±0.10 1.60±0.20 | 1.25±0.10 1.60±0.20 | 2.50±0.30 | 1.25±0.10 1.60±0.20 | 2.00±0.20 |
| A ₀ | 2.00±0.10 | <2.00 | <2.50 | <2.50 | <3.10 | <2.50 | <2.50 |
| B ₀ | 3.50±0.10 | <3.60 | <5.30 | <5.30 | <4.00 | <5.30 | <5.30 |
| T | 0.95±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 |
| K ₀ | - | <2.50 | <2.50 | <2.50 | <3.50 | <2.50 | <2.50 |
| W | 8.00±0.10 | 8.00±0.10 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 |
| P ₀ | 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 |
| 10xP ₀ | 40.00±0.20 | 40.00±0.20 | 40.0±0.20 | 40.0±0.20 | 40.00±0.20 | 40.0±0.20 | 40.0±0.20 |
| P ₁ | 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 ₂ | 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 ₀ | 1.55±0.05 | 1.50 +0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50 +0.10/-0 | 1.50±0.10/-0 | 1.50+0.10/-0 |
| D ₁ | - | 1.00±0.10 | 1.50±0.10 | 1.50±0.10 | 1.00±0.10 | 1.50±0.10 | 1.50±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 | 5.50±0.05 | 5.50±0.05 | 3.50±0.05 | 5.50±0.05 | 5.50±0.05 |
| Unit : | mm | mm | mm | mm | mm | mm | mm |

9. PACKAGE DIMENSION AND QUANTITY

| Size | 1812 | | 1825 | | 2220 | |
|-------------------|-------------------------------------|---------------|------------------------|---------------|-------------------------------------|---------------|
| Chip Thickness | 1.25±0.10 1.60±0.20 2.00±0.20 | 2.50±0.30 | 1.60±0.20 2.00±0.20 | 2.50±0.30 | 1.40±0.15 1.60±0.20 2.00±0.20 | 2.50±0.30 |
| A ₀ | <3.90 | <3.90 | <6.80 | <6.80 | <5.80 | <6.80 |
| B ₀ | <5.30 | <5.30 | <5.30 | <5.30 | <6.50 | <6.50 |
| T | 0.25±0.05 | 0.25±0.05 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 |
| K ₀ | <2.50 | <3.00 | <2.50 | <3.10 | <2.50 | <3.10 |
| W | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 |
| P ₀ | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |
| 10xP ₀ | 40.00±0.20 | 40.00±0.20 | 40.00±0.20 | 40.00±0.20 | 40.00±0.20 | 40.00±0.20 |
| P ₁ | 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 ₂ | 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 ₀ | 1.50 +0.10/-0 | 1.50 +0.10/-0 | 1.50 +0.10/-0 | 1.50 +0.10/-0 | 1.50 +0.10/-0 | 1.50 +0.10/-0 |
| D ₁ | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±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 |
| F | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 |
| Unit : | mm | mm | mm | mm | mm | mm |

| Size | 2225 | |
|-------------------|------------------------|---------------|
| Chip Thickness | 1.60±0.20 2.00±0.20 | 2.50±0.30 |
| A ₀ | <6.80 | <6.80 |
| B ₀ | <6.50 | <6.50 |
| T | 0.30±0.10 | 0.30±0.10 |
| K ₀ | <2.50 | <3.10 |
| W | 12.00±0.20 | 12.00±0.20 |
| P ₀ | 4.00±0.10 | 4.00±0.10 |
| 10xP ₀ | 40.00±0.20 | 40.00±0.20 |
| P ₁ | 8.00±0.10 | 8.00±0.10 |
| P ₂ | 2.00±0.05 | 2.00±0.05 |
| D ₀ | 1.50 +0.10/-0 | 1.50 +0.10/-0 |
| D ₁ | 1.50±0.10 | 1.50±0.10 |
| E | 1.75±0.10 | 1.75±0.10 |
| F | 5.50±0.05 | 5.50±0.05 |
| Unit : | mm | mm |

9. PACKAGE DIMENSION AND QUANTITY

9.2. REEL DIMENSIONS

| Size | 0402, 0603, 0805, 1206, 1210 | | 1808, 1812, 1825, 2220, 2225 |
|----------------|---------------------------------|-------------------|---------------------------------|
| Reel size | 7" | 13" | 7" |
| C | 13.0 +0.5/-0.2 | 13.0 +0.7/-0.3 | 13.0 +0.5/-0.2 |
| W ₁ | 8.4 +1.5/-0 | 8.4 +2.0/-0 | 12.4 +2.0/-0 |
| A | 178.0 ±0.10 | 330.0 ±1.0 | 178.0 ±0.10 |
| N | 60.0 +1.0/-0 | 100 ±1.0 | 60.0 +1.0/-0 |

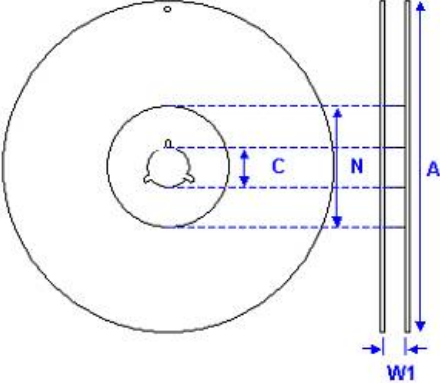
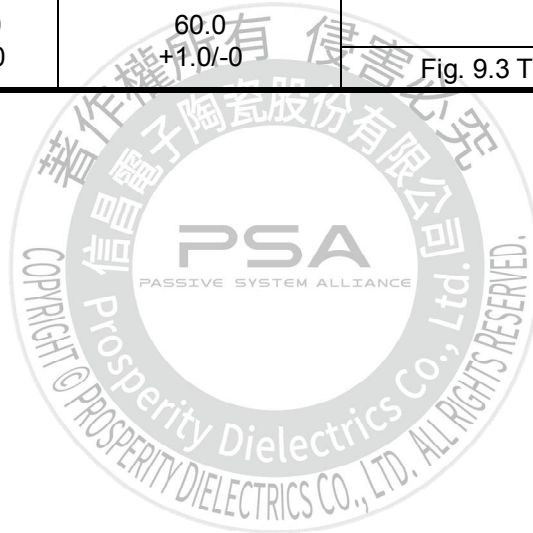


Fig. 9.3 The dimension of reel



10. APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended :
 Indoors under 5 ~ 40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The product is recommended to be used within 12 months after shipment and checked the solderability before use.

HANDLING

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

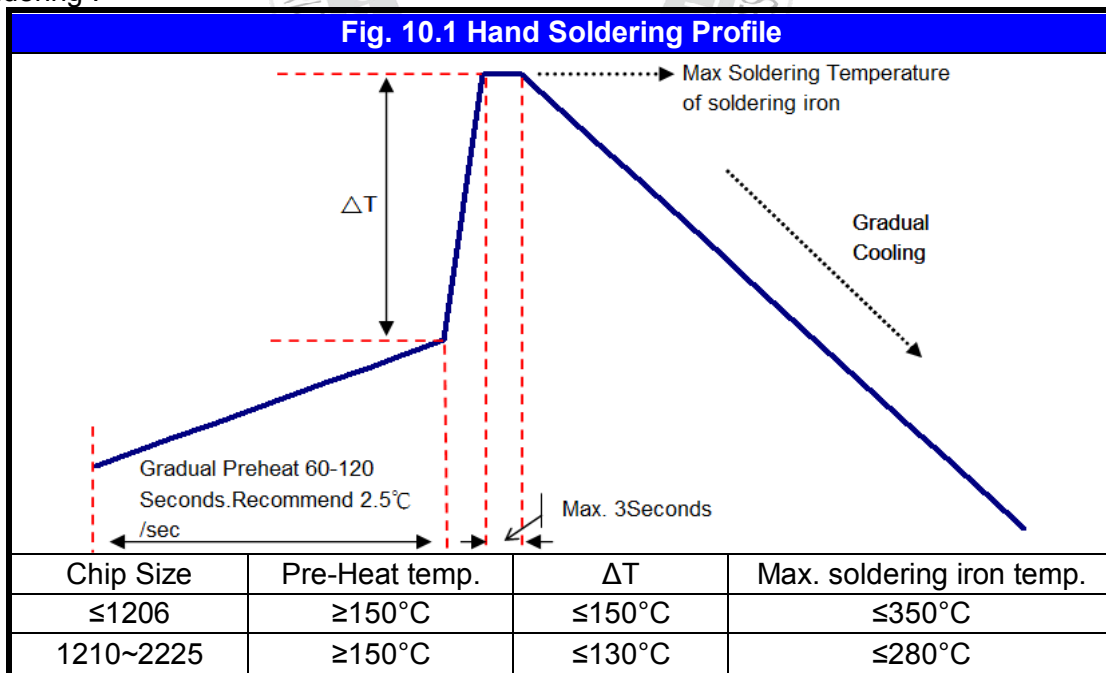
PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

SOLDERING

Use mildly activated rosin fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

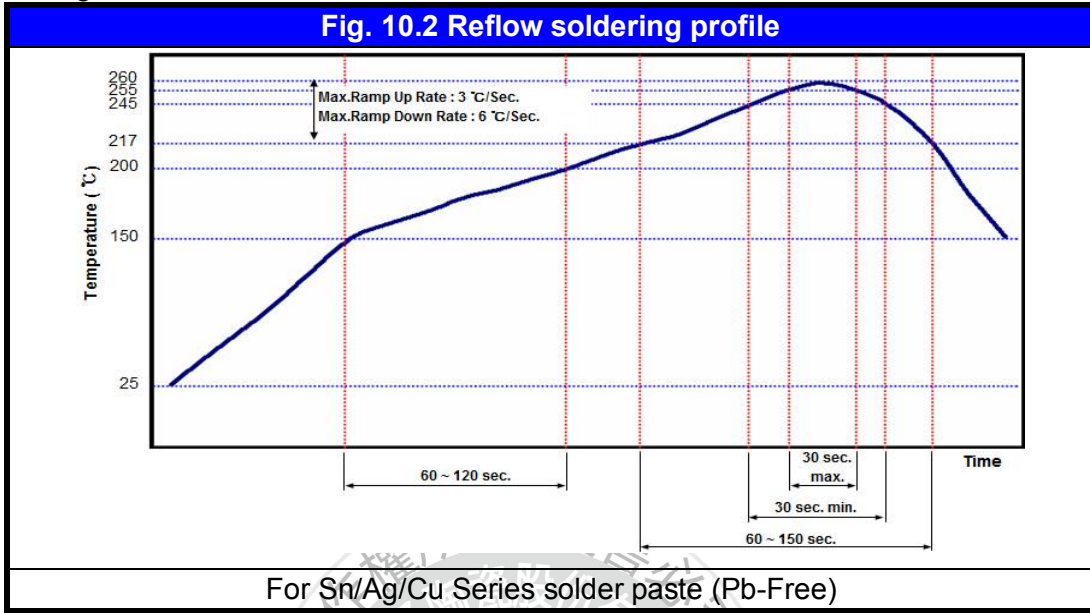
a.) Hand soldering :



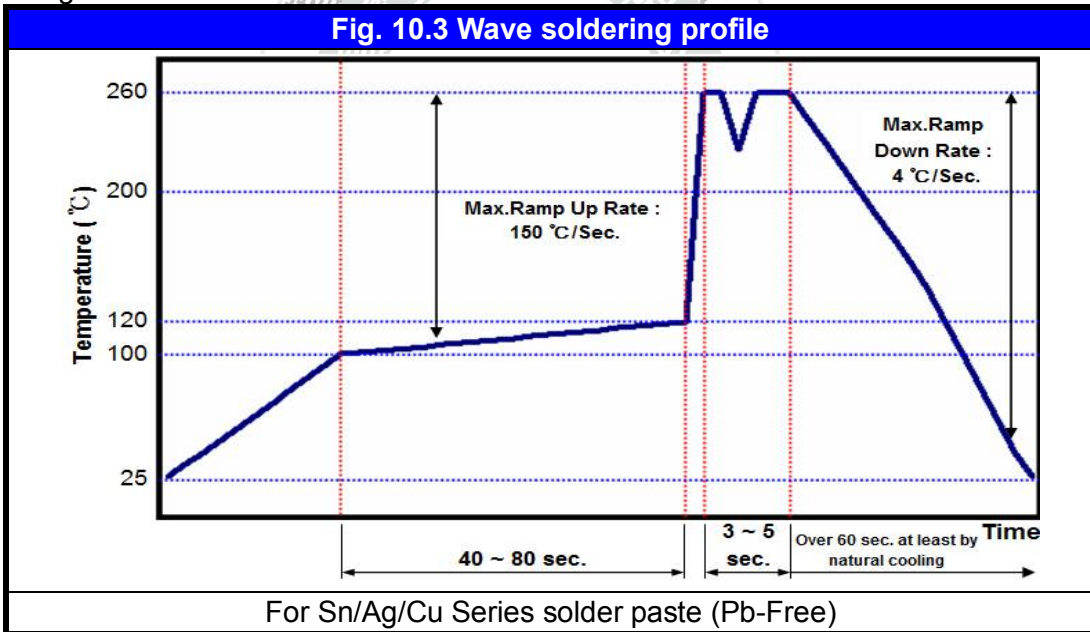
- * Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- * The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- * The required amount of solder shall be melted on the soldering tip.
- * The tip of iron should not contact the ceramic body directly.
- * The Capacitors shall be cooled gradually at room temperature after soldering.
- * Forced air cooling is not allowed.

10. APPLICATION NOTES

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

| Size Inch (mm) | Temper. Cher. | Capacitance | Condition | |
|------------------|---------------|-------------------|-----------|--------|
| | | | Wave | Reflow |
| ≤0402 (1005) | Class I | All | X | O |
| 0603 (1608) | Class I | All | O | O |
| 0805 (2012) | Class I | All | O | O |
| 1206 (3216) | Class I | All | O | O |
| | | Thickness >0.95mm | X | O |
| ≥1210 (3225) | Class I | All | X | O |
| Coating Products | All | All | X | O |

10. APPLICATION NOTES

Soldering conditions :
 Class II :

| Size Inch (mm) | Temper. Cher. | Capacitance | Condition | |
|------------------|---------------|--------------------|-----------|--------|
| | | | Wave | Reflow |
| ≤0402 (1005) | Class II | All | X | O |
| 0603 (1608) | Class II | Cap. <2.2μF | O | O |
| | | Cap. ≥2.2μF | X | O |
| 0805 (2012) | Class II | Thickness ≤ 0.95mm | O | O |
| | | Thickness > 0.95mm | X | O |
| 1206 (3216) | Class II | Thickness ≤ 0.95mm | O | O |
| | | Thickness > 0.95mm | X | O |
| ≥1210 (3225) | Class II | All | X | O |
| Coating Products | All | All | X | O |

Soldering height :

The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less.
 (Reference from IPC-610E)

The diagram illustrates a cross-section of a chip on a substrate. The chip is shown as a yellow rectangular block. The substrate is shown as a grey block. The soldering height is indicated by a vertical double-headed arrow on the right side of the chip, showing the height of the solder joint. The chip thickness is indicated by a vertical double-headed arrow on the left side of the chip.

COOLING

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint.

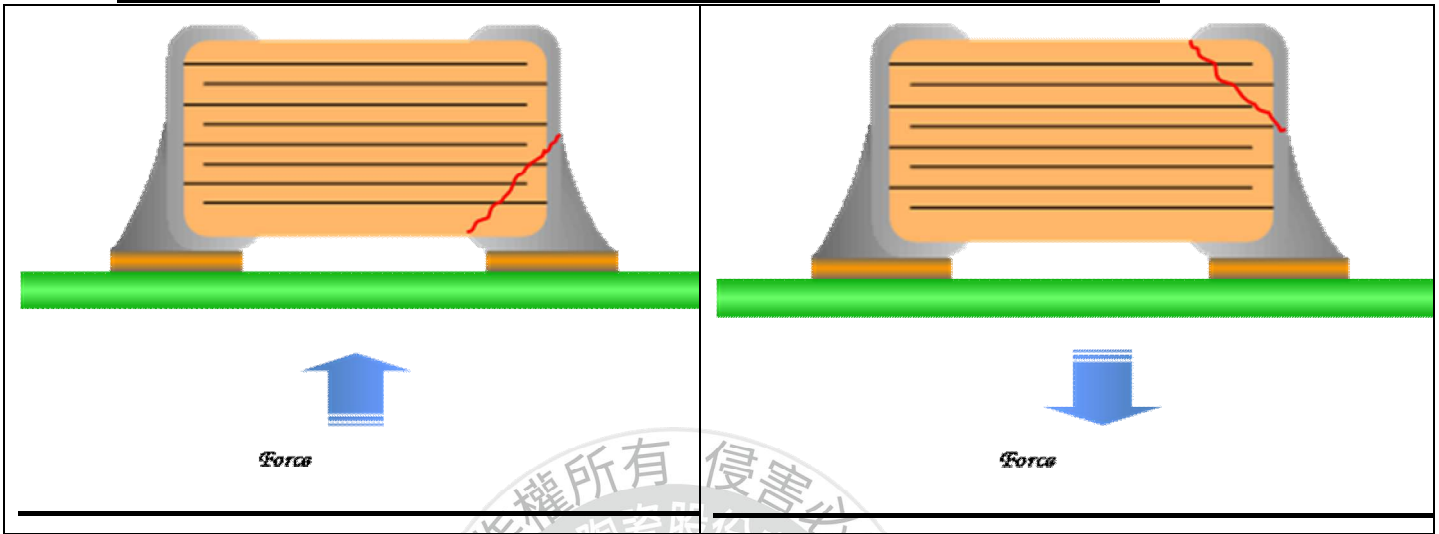
CLEANING

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

Surface coating products are not suitable cleaning/washing by solvent

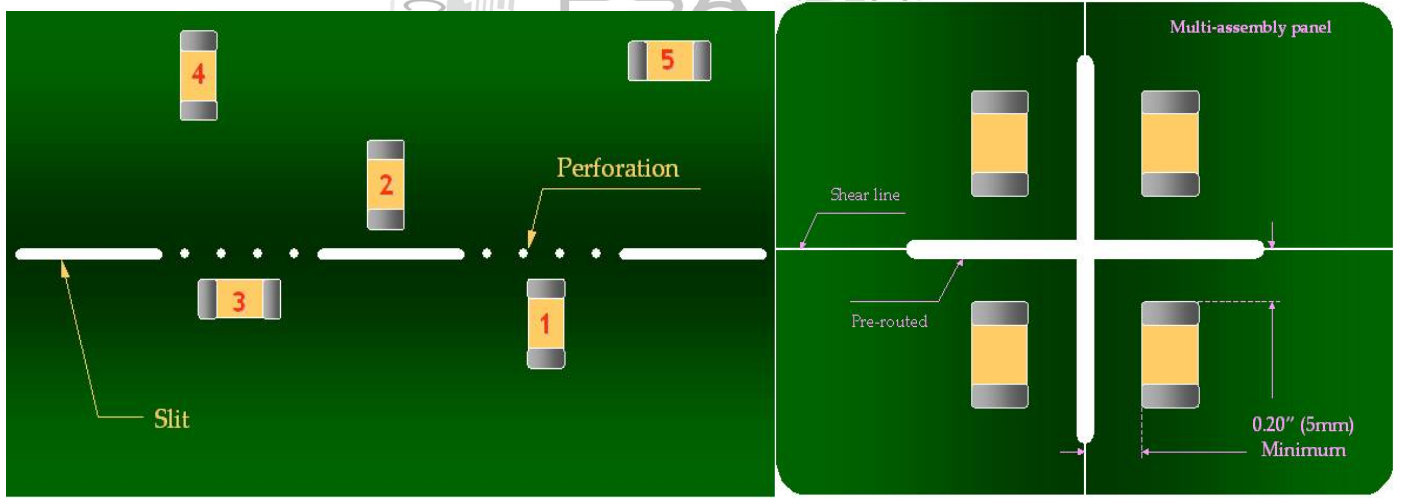
11. Typical Bending Cracks of MLCC

MLCC ceramic body is consisted of rigidity material. It will be suffered compressive and tensional stress when the carried board is bended. If the suffered stress is over ceramic body strength, the bending crack is occurred. **Therefore, the bending crack will be only occurred after soldering process.**



12. The stress v.s. position on PCB during bending

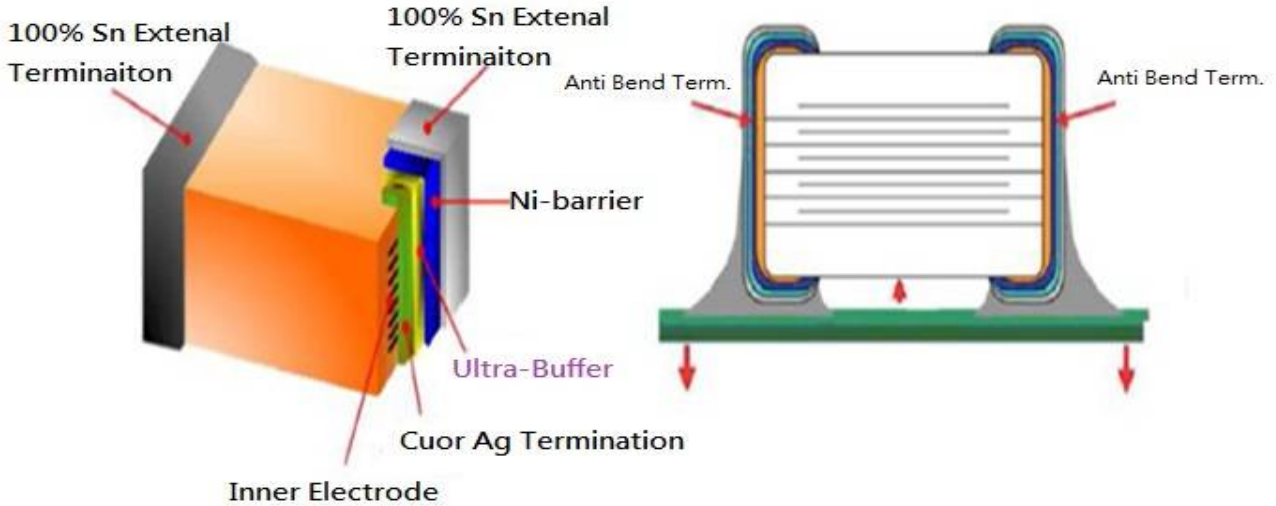
Chip mounting close to board separation point



Magnitude of stress $1 > 2 \approx 3 > 4 > 5$

13. Structure

PDC soft termination series is added a special termination material(Ultra-Buffer or Anti-Bend)between ceramic body and Ni-barrier that can absorb mechanical stress to prevent bending crack occurred



14. Illustration of Bending Test

