

General Multilayer Ceramic Capacitors



MLCC is an electronic part that temporarily stores an electrical charge and the most prevalent type of capacitor today. New technologies have enabled the MLCC manufacturers to follow the trend dictated by smaller and smaller electronic devices such as Cellular telephones, Computers, DSC, DVC

General Features

- Miniature Size
- Wide Capacitance and Voltage Range
- Tape & Reel for Surface Mount Assembly
- Low ESR

Applications

- General Electronic Circuit

Part Numbering

CL **10** **B** **104** **K** **B** **8** **N** **N** **N** **C**
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

- | | |
|--|----------------------------|
| ① Samsung Multilayer Ceramic Capacitor | ⑦ Thickness Option |
| ② Size(mm) | ⑧ Product & Plating Method |
| ③ Capacitance Temperature Characteristic | ⑨ Samsung Control Code |
| ④ Nominal Capacitance | ⑩ Reserved For Future Use |
| ⑤ Capacitance Tolerance | ⑪ Packaging Type |
| ⑥ Rated Voltage | |

① Samsung Multilayer Ceramic Capacitor

② SIZE(mm)

| Code | EIA CODE | Size(mm) |
|------|----------|------------|
| 03 | 0201 | 0.6 × 0.3 |
| 05 | 0402 | 1.0 × 0.5 |
| 10 | 0603 | 1.6 × 0.8 |
| 21 | 0805 | 2.0 × 1.25 |
| 31 | 1206 | 3.2 × 1.6 |
| 32 | 1210 | 3.2 × 2.5 |
| 43 | 1812 | 4.5 × 3.2 |
| 55 | 2220 | 5.7 × 5.0 |

③ CAPACITANCE TEMPERATURE CHARACTERISTIC

| Code | Temperature Characteristics | | | | Temperature Range |
|------|-----------------------------|-----|-----|----------------|-------------------|
| C | Class I | COG | C△ | 0 ± 30(ppm/°C) | -55 ~ +125°C |
| P | | P2H | P△ | -150 ± 60 | |
| R | | R2H | R△ | -220 ± 60 | |
| S | | S2H | S△ | -330 ± 60 | |
| T | | T2H | T△ | -470 ± 60 | |
| U | | U2J | U△ | -750 ± 60 | |
| L | | S2L | S△ | +350 ~ -1000 | |
| A | Class II | X5R | X5R | ± 15% | -55 ~ +85°C |
| B | | X7R | X7R | ± 15% | -55 ~ +125°C |
| X | | X6S | X6S | ± 22% | -55 ~ +105°C |
| F | | Y5V | Y5V | +22 ~ -82% | -30 ~ +85°C |

※ Temperature Characteristic

| Temperature Characteristics | Below 2.0pF | 2.2 ~ 3.9pF | Above 4.0pF | Above 10pF |
|-----------------------------|-------------|-------------|-------------|------------|
| C△ | C0G | C0G | C0G | C0G |
| P△ | - | P2J | P2H | P2H |
| R△ | - | R2J | R2H | R2H |
| S△ | - | S2J | S2H | S2H |
| T△ | - | T2J | T2H | T2H |
| U△ | - | U2J | U2J | U2J |

J : ±120PPM/°C, H : ±60PPM/°C, G : ±30PPM/°C

④ NOMINAL CAPACITANCE

Nominal capacitance is identified by 3 digits.

The first and second digits identify the first and second significant figures of the capacitance.

The third digit identifies the multiplier. 'R' identifies a decimal point.

● Example

| Code | Nominal Capacitance |
|------|--------------------------|
| 1R5 | 1.5pF |
| 103 | 10,000pF, 10nF, 0.01 μF |
| 104 | 100,000pF, 100nF, 0.1 μF |

⑤ CAPACITANCE TOLERANCE

| Code | Tolerance | Nominal Capacitance |
|------|---------------------|------------------------------------|
| A | $\pm 0.05\text{pF}$ | Less than 10pF (Including 10pF) |
| B | $\pm 0.1\text{pF}$ | |
| C | $\pm 0.25\text{pF}$ | |
| D | $\pm 0.5\text{pF}$ | |
| F | $\pm 1\text{pF}$ | |
| F | $\pm 1\%$ | More than 10pF |
| G | $\pm 2\%$ | |
| J | $\pm 5\%$ | |
| K | $\pm 10\%$ | |
| M | $\pm 20\%$ | |
| Z | +80, -20% | |

⑥ RATED VOLTAGE

| Code | Rated Voltage | Code | Rated Voltage |
|------|---------------|------|---------------|
| R | 4.0V | D | 200V |
| Q | 6.3V | E | 250V |
| P | 10V | G | 500V |
| O | 16V | H | 630V |
| A | 25V | I | 1,000V |
| L | 35V | J | 2,000V |
| B | 50V | K | 3,000V |
| C | 100V | | |

7 THICKNESS OPTION

| Size | Code | Thickness(T) | Size | Code | Thickness(T) |
|------------|-----------|--------------|------------|----------|--------------|
| 0201(0603) | 3 | 0.30±0.03 | 1812(4532) | F | 1.25±0.20 |
| 0402(1005) | 5 | 0.50±0.05 | | H | 1.6±0.20 |
| 0603(1608) | 8 | 0.80±0.10 | | I | 2.0±0.20 |
| 0805(2012) | A | 0.65±0.10 | | J | 2.5±0.20 |
| | C | 0.85±0.10 | | L | 3.2±0.30 |
| | F | 1.25±0.10 | 2220(5750) | F | 1.25±0.20 |
| Q | 1.25±0.15 | H | | 1.6±0.20 | |
| Y | 1.25±0.20 | I | | 2.0±0.20 | |
| 1206(3216) | C | 0.85±0.15 | | J | 2.5±0.20 |
| | F | 1.25±0.15 | | L | 3.2±0.30 |
| | H | 1.6±0.20 | | | |
| 1210(3225) | F | 1.25±0.20 | | | |
| | H | 1.6±0.20 | | | |
| | I | 2.0±0.20 | | | |
| | J | 2.5±0.20 | | | |
| | V | 2.5±0.30 | | | |

8 PRODUCT & PLATING METHOD

| Code | Electrode | Termination | Plating Type |
|----------|-----------|-------------|--------------|
| A | Pd | Ag | Sn_100% |
| N | Ni | Cu | Sn_100% |
| G | Cu | Cu | Sn_100% |

9 SAMSUNG CONTROL CODE

| Code | Description of the code | Code | Description of the code |
|----------|-------------------------|----------|-------------------------|
| A | Array (2-element) | N | Normal |
| B | Array (4-element) | P | Automotive |
| C | High - Q | L | LICC |

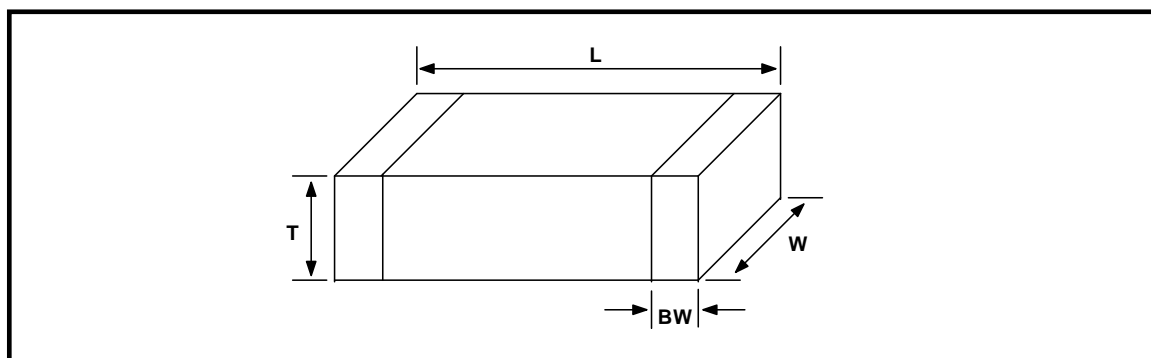
Ⓜ RESERVED FOR FUTURE USE

| Code | Description of the code |
|------|-------------------------|
| N | Reserved for future use |

Ⓜ PACKAGING TYPE

| Code | Packaging Type | Code | Packaging Type |
|------|----------------------|------|--------------------------|
| B | Bulk | F | Embossing 13" (10,000EA) |
| P | Bulk Case | L | Paper 13" (15,000EA) |
| C | Paper 7" | O | Paper 10" |
| D | Paper 13" (10,000EA) | S | Embossing 10" |
| E | Embossing 7" | | |

APPEARANCE AND DIMENSION

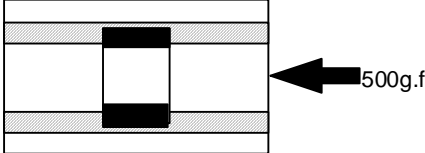
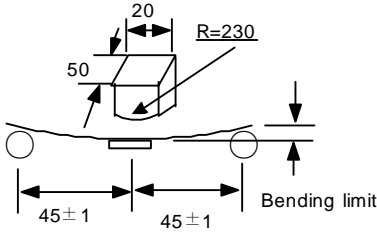


| CODE | EIA CODE | DIMENSION (mm) | | | |
|------|----------|------------------|------------|---------|----------------|
| | | L | W | T (MAX) | BW |
| 03 | 0201 | 0.6 ± 0.03 | 0.3 ± 0.03 | 0.33 | 0.15 ± 0.05 |
| 05 | 0402 | 1.0 ± 0.05 | 0.5 ± 0.05 | 0.55 | 0.2 +0.15/-0.1 |
| 10 | 0603 | 1.6 ± 0.1 | 0.8 ± 0.1 | 0.9 | 0.3 ± 0.2 |
| 21 | 0805 | 2.0 ± 0.1 | 1.25 ± 0.1 | 1.35 | 0.5 +0.2/-0.3 |
| 31 | 1206 | 3.2 ± 0.15 | 1.6 ± 0.15 | 1.40 | 0.5 +0.2/-0.3 |
| | | 3.2 ± 0.2 | 1.6 ± 0.2 | 1.8 | 0.5 +0.3/-0.3 |
| 32 | 1210 | 3.2 ± 0.3 | 2.5 ± 0.2 | 2.7 | 0.6 ± 0.3 |
| | | 3.2 ± 0.4 | 2.5 ± 0.3 | 2.8 | |
| 43 | 1812 | 4.5 ± 0.4 | 3.2 ± 0.3 | 3.5 | 0.8 ± 0.3 |
| 55 | 2220 | 5.7 ± 0.4 | 5.0 ± 0.4 | 3.5 | 1.0 ± 0.3 |

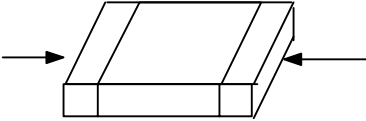
RELIABILITY TEST CONDITION

| NO | ITEM | PERFORMANCE | TEST CONDITION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------|-----------------------|--|--|------------------------------------|--------------|-----------|-----|-----------|-----|----------|------|---------------------|---------------|------|-----|---------------------|-----|----------|-----|------------------------------------|-----|----------------------|-----|----------------------|------|---------|-------------|-----------|---------|
| 1 | Appearance | No Abnormal Exterior Appearance | Through Microscope(x10) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Insulation Resistance | 10,000M Ω or 500M Ω · μ F whichever is smaller Rated Voltage is below 16V ; 10,000M Ω or 100M Ω · μ F whichever is smaller | Apply the Rated Voltage For 60 ~ 120 Sec. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Withstanding Voltage | No Dielectric Breakdown or Mechanical Breakdown | Class I : 300% of the Rated Voltage for 1~5 sec. Class II :250% of the Rated Voltage for 1~5 sec. is applied with less than 50mA current | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Capacitance | Class I Within the specified tolerance | Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\leq 1,000$ pF | 1kHz \pm 10% | 0.5 ~ 5 Vrms | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $>1,000$ pF | 1kHz \pm 10% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Class II Within the specified tolerance | Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 10 μ F | 1kHz \pm 10% | | 1.0 \pm 0.2Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | >10 μ F | 120 Hz \pm 20% | 0.5 \pm 0.1Vrms | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Q | Class I Capacitance ≥ 30 pF : Q $\geq 1,000$ < 30 pF : Q $\geq 400 +20C$ (C : Capacitance) | Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\leq 1,000$ pF | 1kHz \pm 10% | 0.5 ~ 5 Vrms | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $>1,000$ pF | 1kHz \pm 10% | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Tan δ | Class II 1. Characteristic : A(X5R), B(X7R), X(X6S) <table border="1" data-bbox="414 1064 893 1232"> <thead> <tr> <th>Rated Voltage</th> <th>Spec</th> </tr> </thead> <tbody> <tr> <td>$\geq 25V$</td> <td>0.025 max</td> </tr> <tr> <td>16V</td> <td>0.035 max</td> </tr> <tr> <td>10V</td> <td>0.05 max</td> </tr> <tr> <td>6.3V</td> <td>0.05 max/ 0.10max*1</td> </tr> </tbody> </table> 2. Characteristic : F(Y5V) <table border="1" data-bbox="414 1321 893 1579"> <thead> <tr> <th>Rated Voltage</th> <th>Spec</th> </tr> </thead> <tbody> <tr> <td>50V</td> <td>0.05 max, 0.07max*2</td> </tr> <tr> <td>35V</td> <td>0.07 max</td> </tr> <tr> <td>25V</td> <td>0.05 max/ 0.07 max*3/ 0.09max*4</td> </tr> <tr> <td>16V</td> <td>0.09 max/ 0.125max*5</td> </tr> <tr> <td>10V</td> <td>0.125 max/ 0.16max*6</td> </tr> <tr> <td>6.3V</td> <td>0.16max</td> </tr> </tbody> </table> | Rated Voltage | Spec | $\geq 25V$ | 0.025 max | 16V | 0.035 max | 10V | 0.05 max | 6.3V | 0.05 max/ 0.10max*1 | Rated Voltage | Spec | 50V | 0.05 max, 0.07max*2 | 35V | 0.07 max | 25V | 0.05 max/ 0.07 max*3/ 0.09max*4 | 16V | 0.09 max/ 0.125max*5 | 10V | 0.125 max/ 0.16max*6 | 6.3V | 0.16max | Capacitance | Frequency | Voltage |
| | | | Rated Voltage | Spec | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\geq 25V$ | 0.025 max | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 16V | 0.035 max | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 10V | 0.05 max | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 6.3V | 0.05 max/ 0.10max*1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Rated Voltage | Spec | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 50V | 0.05 max, 0.07max*2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 35V | 0.07 max | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 25V | 0.05 max/ 0.07 max*3/ 0.09max*4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | 0.09 max/ 0.125max*5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | 0.125 max/ 0.16max*6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | 0.16max | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 10 μ F | 1kHz \pm 10% | 1.0 \pm 0.2Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| >10 μ F | 120Hz \pm 20% | 0.5 \pm 0.1Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | *1. 0201 C \geq 0.022uF, 0402 C \geq 0.22uF, 0603 C \geq 2.2uF, 0805 C \geq 4.7uF, 1206 C \geq 10uF, 1210 C \geq 22uF, 1812 C \geq 47uF, 2220 C \geq 100uF, All Low Profile Capacitors (P.16). *2.. 0603 C \geq 0.47uF, 0805 C \geq 1uF *3. 0402 C \geq 0.033uF, 0603 C $>$ 0.1uF All 0805, 1206 size, 1210 C \leq 6.8uF *4.. 1210 C $>$ 6.8uF *5.. 0402 C \geq 0.22uF *6.. All 1812 size | | | | | | | | | | | | | | | | | | | | | | | | | | |

RELIABILITY TEST CONDITION

| NO | ITEM | | PERFORMANCE | | TEST CONDITION | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|--|---|---|---|----------------------------|---------|---|----------|------------------------|----------------|-----------|--------------|-----------|----|-----------|----|------------|----|--------------|--|--|------|-----------|---|--------|---|--------------------------|---|--------|---|-------------------------|---|--------|
| 7 | Temperature Characteristics of Capacitance | Class I | <table border="1"> <thead> <tr> <th>Characteristics</th> <th>Temp. Coefficient (PPM/°C)</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>0 ± 30</td> </tr> <tr> <td>PH</td> <td>-150 ± 60</td> </tr> <tr> <td>RH</td> <td>-220 ± 60</td> </tr> <tr> <td>SH</td> <td>-330 ± 60</td> </tr> <tr> <td>TH</td> <td>-470 ± 60</td> </tr> <tr> <td>UL</td> <td>-750 ± 120</td> </tr> <tr> <td>SL</td> <td>+350 ~ -1000</td> </tr> </tbody> </table> | Characteristics | Temp. Coefficient (PPM/°C) | C0G | 0 ± 30 | PH | -150 ± 60 | RH | -220 ± 60 | SH | -330 ± 60 | TH | -470 ± 60 | UL | -750 ± 120 | SL | +350 ~ -1000 | | <p>Capacitance shall be measured by the steps shown in the following table.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25 ± 2</td> </tr> <tr> <td>2</td> <td>Min. operating temp. ± 2</td> </tr> <tr> <td>3</td> <td>25 ± 2</td> </tr> <tr> <td>4</td> <td>Max. operating temp ± 2</td> </tr> <tr> <td>5</td> <td>25 ± 2</td> </tr> </tbody> </table> <p>(1) Class I Temperature Coefficient shall be calculated from the formula as below. Temp. Coefficient = $\frac{C2 - C1}{C1 \times \Delta T} \times 10^6$ [ppm/°C] C1; Capacitance at step 3 C2: Capacitance at 85°C ΔT: 60°C (=85°C-25°C)</p> <p>(2) CLASS II Capacitance Change shall be calculated from the formula as below. $\Delta C = \frac{C2 - C1}{C1} \times 100(\%)$ C1; Capacitance at step 3 C2: Capacitance at step 2 or 4</p> | Step | Temp.(°C) | 1 | 25 ± 2 | 2 | Min. operating temp. ± 2 | 3 | 25 ± 2 | 4 | Max. operating temp ± 2 | 5 | 25 ± 2 |
| | | Characteristics | Temp. Coefficient (PPM/°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C0G | 0 ± 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PH | -150 ± 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RH | -220 ± 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SH | -330 ± 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TH | -470 ± 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UL | -750 ± 120 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SL | +350 ~ -1000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temp.(°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25 ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Min. operating temp. ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 25 ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Max. operating temp ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 25 ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Class II | <table border="1"> <thead> <tr> <th>Characteristics</th> <th>Capacitance Change with No Bias</th> </tr> </thead> <tbody> <tr> <td>A(X5R)/ B(X7R)</td> <td>± 15%</td> </tr> <tr> <td>X(X6S)</td> <td>± 22%</td> </tr> <tr> <td>F(Y5V)</td> <td>+22% ~ -82%</td> </tr> </tbody> </table> | Characteristics | Capacitance Change with No Bias | A(X5R)/ B(X7R) | ± 15% | X(X6S) | ± 22% | F(Y5V) | +22% ~ -82% | | | | | | | | | | | | | | | | | | | | | | | | |
| Characteristics | Capacitance Change with No Bias | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A(X5R)/ B(X7R) | ± 15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X(X6S) | ± 22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F(Y5V) | +22% ~ -82% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Adhesive Strength of Termination | No Indication Of Peeling Shall Occur On The Terminal Electrode. | | <p>Apply 500g.f * Pressure for 10± 1 sec. * 200g.f for 0201 case size.</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Bending Strength | Apperance | No mechanical damage shall occur. | <p>Bending limit ; 1mm Test speed ; 1.0mm/SEC. Keep the test board at the limit point in 5 sec., Then measure capacitance.</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance | <table border="1"> <thead> <tr> <th>Characteristics</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>Class I</td> <td>Within ± 5% or ± 0.5 pF whichever is larger</td> </tr> <tr> <td rowspan="2">Class II</td> <td>A(X5R)/ B(X7R)/ X(X6S)</td> <td>Within ± 12.5%</td> </tr> <tr> <td>F(Y5V)</td> <td>Within ± 30%</td> </tr> </tbody> </table> | Characteristics | Capacitance Change | Class I | Within ± 5% or ± 0.5 pF whichever is larger | Class II | A(X5R)/ B(X7R)/ X(X6S) | Within ± 12.5% | F(Y5V) | Within ± 30% | | | | | | | | | | | | | | | | | | | | | |
| Characteristics | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Class I | Within ± 5% or ± 0.5 pF whichever is larger | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Class II | A(X5R)/ B(X7R)/ X(X6S) | Within ± 12.5% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | F(Y5V) | Within ± 30% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

RELIABILITY TEST CONDITION

| NO | ITEM | PERFORMANCE | TEST CONDITION | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|------------------------------|--|---|--|--------------|--------------------|--------------|--------|--|----------|----------------|--------------|----------|-------------|------------|-------------|--|------|----------|------------|---|--------|----|---|---------|----|
| 10 | Solderability | <p>More Than 75% of the terminal surface is to be soldered newly, So metal part does not come out or dissolve</p>  | <table border="1"> <tr> <td>Solder</td> <td>Sn-3Ag-0.5Cu</td> <td>63Sn-37Pb</td> </tr> <tr> <td>Solder Temp.</td> <td>245±5℃</td> <td>235±5℃</td> </tr> <tr> <td>Flux</td> <td colspan="2">RMA Type</td> </tr> <tr> <td>Dip Time</td> <td>3±0.3 sec.</td> <td>5±0.5 sec.</td> </tr> <tr> <td>Pre-heating</td> <td colspan="2">at 80~120℃ for 10~30 sec.</td> </tr> </table> | Solder | Sn-3Ag-0.5Cu | 63Sn-37Pb | Solder Temp. | 245±5℃ | 235±5℃ | Flux | RMA Type | | Dip Time | 3±0.3 sec. | 5±0.5 sec. | Pre-heating | at 80~120℃ for 10~30 sec. | | | | | | | | | |
| Solder | Sn-3Ag-0.5Cu | 63Sn-37Pb | | | | | | | | | | | | | | | | | | | | | | | | |
| Solder Temp. | 245±5℃ | 235±5℃ | | | | | | | | | | | | | | | | | | | | | | | | |
| Flux | RMA Type | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dip Time | 3±0.3 sec. | 5±0.5 sec. | | | | | | | | | | | | | | | | | | | | | | | | |
| Pre-heating | at 80~120℃ for 10~30 sec. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Resistance to Soldering heat | <p>Appearance: No mechanical damage shall occur.</p> <table border="1"> <tr> <td rowspan="4">Capacitance</td> <td colspan="2">Characteristics</td> <td>Capacitance Change</td> </tr> <tr> <td colspan="2">Class I</td> <td>Within ±2.5% or ±0.25 pF whichever is larger</td> </tr> <tr> <td rowspan="3">Class II</td> <td>A(X5R)/ B(X7R)</td> <td>Within ±7.5%</td> </tr> <tr> <td>X(X6S)</td> <td>Within ±15%</td> </tr> <tr> <td>F</td> <td>Within ±20%</td> </tr> </table> <p>Q (Class I): Capacitance ≥ 30pF : Q ≥ 1000 <30 pF : Q ≥ 400+20×C (C: Capacitance)</p> <p>Tan δ (Class II): Within the specified initial value</p> <p>Insulation Resistance: Within the specified initial value</p> <p>Withstanding Voltage: Within the specified initial value</p> | Capacitance | Characteristics | | Capacitance Change | Class I | | Within ±2.5% or ±0.25 pF whichever is larger | Class II | A(X5R)/ B(X7R) | Within ±7.5% | X(X6S) | Within ±15% | F | Within ±20% | <p>Solder Temperature : 270±5℃</p> <p>Dip Time : 10±1 sec.</p> <p>Each termination shall be fully immersed and preheated as below :</p> <table border="1"> <thead> <tr> <th>STEP</th> <th>TEMP.(℃)</th> <th>TIME(SEC.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>80~100</td> <td>60</td> </tr> <tr> <td>2</td> <td>150~180</td> <td>60</td> </tr> </tbody> </table> <p>Leave the capacitor in ambient condition for specified time* before measurement</p> <p>* 24 ± 2 hours (Class I) 24 ± 2 hours (Class II)</p> | STEP | TEMP.(℃) | TIME(SEC.) | 1 | 80~100 | 60 | 2 | 150~180 | 60 |
| Capacitance | Characteristics | | | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | |
| | Class I | | | Within ±2.5% or ±0.25 pF whichever is larger | | | | | | | | | | | | | | | | | | | | | | |
| | Class II | A(X5R)/ B(X7R) | | Within ±7.5% | | | | | | | | | | | | | | | | | | | | | | |
| | | X(X6S) | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | |
| F | | Within ±20% | | | | | | | | | | | | | | | | | | | | | | | | |
| STEP | TEMP.(℃) | TIME(SEC.) | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 80~100 | 60 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 150~180 | 60 | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Vibration Test | <p>Appearance: No mechanical damage shall occur.</p> <table border="1"> <tr> <td rowspan="4">Capacitance</td> <td colspan="2">Characteristics</td> <td>Capacitance Change</td> </tr> <tr> <td colspan="2">Class I</td> <td>Within ±2.5% or ±0.25 pF whichever is larger</td> </tr> <tr> <td rowspan="3">Class II</td> <td>A(X5R)/ B(X7R)</td> <td>Within ±5%</td> </tr> <tr> <td>X(X6S)</td> <td>Within ±10%</td> </tr> <tr> <td>F(Y5V)</td> <td>Within ±20%</td> </tr> </table> <p>Q (Class I): Within the specified initial value</p> <p>Tan δ (Class II): Within the specified initial value</p> <p>Insulation Resistance: Within the specified initial value</p> | Capacitance | Characteristics | | Capacitance Change | Class I | | Within ±2.5% or ±0.25 pF whichever is larger | Class II | A(X5R)/ B(X7R) | Within ±5% | X(X6S) | Within ±10% | F(Y5V) | Within ±20% | <p>The capacitor shall be subjected to a Harmonic Motion having a total amplitude of 1.5mm changing frequency from 10Hz to 55Hz and back to 10Hz In 1 min.</p> <p>Repeat this for 2hours each in 3 mutually perpendicular directions</p> | | | | | | | | | |
| Capacitance | Characteristics | | | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | |
| | Class I | | | Within ±2.5% or ±0.25 pF whichever is larger | | | | | | | | | | | | | | | | | | | | | | |
| | Class II | A(X5R)/ B(X7R) | | Within ±5% | | | | | | | | | | | | | | | | | | | | | | |
| | | X(X6S) | Within ±10% | | | | | | | | | | | | | | | | | | | | | | | |
| F(Y5V) | | Within ±20% | | | | | | | | | | | | | | | | | | | | | | | | |

RELIABILITY TEST CONDITION

| NO | ITEM | PERFORMANCE | TEST CONDITION | | | |
|-----------------------|---|--|---|--|--|---|
| 13 | Humidity (Steady State) | Appearance | No mechanical damage shall occur. | Temperature : 40±2 °C Relative humidity : 90~95 %RH Duration time : 500 +12/-0 hr. Leave the capacitor in ambient condition for specified time* before measurement CLASS I : 24±2 Hr. CLASS II : 24±2 Hr. | | |
| | | Capacitance | Characteristics | | Capacitance Change | |
| | | | Class I | | Within ±5.0% or ±0.5pF whichever is larger | |
| | | | Class II | | A(X5R)/ B(X7R)/ X(X6S) | Within ±12.5% |
| | | | | | F(Y5V) | Within ±30% |
| | | Q CLASS I | Capacitance ≥ 30pF : Q ≥ 350 10 ≤ Capacitance < 30pF : Q ≥ 275 + 2.5×C Capacitance < 10pF : Q ≥ 200 + 10×C (C: Capacitance) | | | |
| Tan δ CLASS II | 1. Characteristic : A(X5R), B(X7R) 0.05max (16V and over) 0.075max (10V) 0.075max (6.3V except Table 1) 0.125max* (refer to Table 1) | 2. Characteristic : F(Y5V) 0.075max (25V and over) 0.1max (16V, C<1.0μF) 0.125max(16V, C ≥ 1.0μF) 0.15max (10V) 0.195max (6.3V) | | | | |
| Insulation Resistance | 1,000 MΩ or 50MΩ·μF whichever is smaller. | | | | | |
| 14 | Moisture Resistance | Appearance | No mechanical damage shall occur. | Applied Voltage : rated voltage Temperature : 40±2 °C Humidity : :90~95%RH Duration Time : 500 +12/-0 Hr. Charge/Discharge Current : 50mA max. Perform the initial measurement according to Note1. Perform the final measurement according to Note2. | | |
| | | Capacitance | Characteristics | | Capacitance Change | |
| | | | Class I | | Within ±5.0% or ±0.5pF whichever is larger | |
| | | | Class II | | A(X5R)/ B(X7R)/ X(X6S) | Within ±12.5% Within ±12.5% Within ±30% |
| | | | | | F(Y5V) | Within ±30% Within ±30% |
| | | Q (Class I) | Capacitance ≥ 30pF : Q ≥ 200 Capacitance < 30pF : Q ≥ 100 + 10/3×C (C: Capacitance) | | | |
| Tan δ (Class II) | 1. Characteristic : A(X5R), B(X7R) 0.05max (16V and over) 0.075max (10V) 0.075max (6.3V except Table 1) 0.125max* (refer to Table 1) | 2. Characteristic : F(Y5V) 0.075max (25V and over) 0.1max (16V, C<1.0μF) 0.125max(16V, C ≥ 1.0μF) 0.15max (10V) 0.195max (6.3V) | | | | |
| Insulation Resistance | 500 MΩ or 25MΩ·μF whichever is smaller. | | | | | |

RELIABILITY TEST CONDITION

| NO | ITEM | PERFORMANCE | TEST CONDITION | | | | | | | | | | | | | | | | |
|----------------------------|--|---|--|---|---|--|------------|---|---------------------------|----|---|----|-----|---|---------------------------|----|---|----|-----|
| 15 | High Temperature Resistance | Appearance | No mechanical damage shall occur. | Applied Voltage : 200%* of the rated voltage Temperature : max. operating temperature Duration Time : 1000 +48/-0 Hr. Charge/Discharge Current : 50mA max. * refer to table(3) : 150%/100% of the rated voltage Perform the initial measurement according to Note1 for Class II Perform the final measurement according to Note2. | | | | | | | | | | | | | | | |
| | | Capacitance | Characteristics | | Capacitance Change | | | | | | | | | | | | | | |
| | | | Class I | | Within $\pm 3\%$ or $\pm 0.3\text{pF}$, Whichever is larger | | | | | | | | | | | | | | |
| | | | Class II | | A(X5R)/ B(X7R) | Within $\pm 12.5\%$ | | | | | | | | | | | | | |
| | | | | | X(X6S) | Within $\pm 25\%$ | | | | | | | | | | | | | |
| | | | | | F(Y5V) | Within $\pm 30\%$ Within $\pm 30\%$ | | | | | | | | | | | | | |
| | | Q (Class I) | Capacitance $\geq 30\text{pF}$: $Q \geq 350$ $10 \leq \text{Capacitance} < 30 \text{ pF}$: $Q \geq 275 + 2.5 \times C$ Capacitance $< 10\text{pF}$: $Q \geq 200 + 10 \times C$ (C: Capacitance) | | | | | | | | | | | | | | | | |
| Tan δ (Class II) | 1. Characteristic : A(X5R), B(X7R) 0.05max (16V and over) 0.075max (10V) 0.075max (6.3V except Table 1) 0.125max* (refer to Table 1) | 2. Characteristic : F(Y5V) 0.075max (25V and over) 0.1max(16V, $C < 1.0\mu\text{F}$) 0.125max(16V, $C \geq 1.0\mu\text{F}$) 0.15max (10V) 0.195max (6.3V) | | | | | | | | | | | | | | | | | |
| Insulation Resistance | 1,000 M Ω or 50M $\Omega \cdot \mu\text{F}$ whichever is smaller. | | | | | | | | | | | | | | | | | | |
| 16 | Temperature Cycle | Appearance | No mechanical damage shall occur. | Capacitor shall be subjected to 5 cycles. Condition for 1 cycle : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Step</th> <th style="width: 35%;">Temp.(°C)</th> <th style="width: 50%;">Time(min.)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Min. operating temp.+0/-3</td> <td style="text-align: center;">30</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">25</td> <td style="text-align: center;">2-3</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">Max. operating temp.+3/-0</td> <td style="text-align: center;">30</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">25</td> <td style="text-align: center;">2-3</td> </tr> </tbody> </table> Leave the capacitor in ambient condition for specified time* before measurement * 24 \pm 2 hours (Class I) 24 \pm 2 hours (Class II) | Step | Temp.(°C) | Time(min.) | 1 | Min. operating temp.+0/-3 | 30 | 2 | 25 | 2-3 | 3 | Max. operating temp.+3/-0 | 30 | 4 | 25 | 2-3 |
| | | Step | Temp.(°C) | | Time(min.) | | | | | | | | | | | | | | |
| | | 1 | Min. operating temp.+0/-3 | | 30 | | | | | | | | | | | | | | |
| | | 2 | 25 | | 2-3 | | | | | | | | | | | | | | |
| | | 3 | Max. operating temp.+3/-0 | | 30 | | | | | | | | | | | | | | |
| | | 4 | 25 | | 2-3 | | | | | | | | | | | | | | |
| | | Capacitance | Characteristics | | Capacitance Change | | | | | | | | | | | | | | |
| Class I | | | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ Whichever is larger | | | | | | | | | | | | | | | | |
| Class II | A(X5R)/ B(X7R) | | Within $\pm 7.5\%$ | | | | | | | | | | | | | | | | |
| | X(X6S) | | Within $\pm 15\%$ | | | | | | | | | | | | | | | | |
| | F(Y5V) | | Within $\pm 20\%$ | | | | | | | | | | | | | | | | |
| Q (Class I) | Within the specified initial value | | | | | | | | | | | | | | | | | | |
| Tan δ (Class II) | Within the specified initial value | | | | | | | | | | | | | | | | | | |
| Insulation Resistance | Within the specified initial value | | | | | | | | | | | | | | | | | | |

RELIABILITY TEST CONDITION

| | | Recommended Soldering Method | | | | |
|-------------|--|------------------------------|-------------------------------|-------------------|-----------|--------|
| | | Size inch (mm) | Temperature Characteristic | Capacitance | Condition | |
| | | | | | Flow | Reflow |
| 18 | Recommended Soldering Method By Size & Capacitance | 0201 (0603) | - | - | - | ○ |
| | | 0402 (1005) | | | - | ○ |
| | | 0603 (1608) | Class I | - | ○ | ○ |
| | | | Class II | $C < 1\mu F$ | ○ | ○ |
| | | $C \geq 1\mu F$ | | - | ○ | |
| | | 0805 (2012) | Class I | - | ○ | ○ |
| | | | Class II | $C < 4.7\mu F$ | ○ | ○ |
| | | | | $C \geq 4.7\mu F$ | - | ○ |
| | | | Array | - | - | ○ |
| | | 1206 (3216) | Class I | - | ○ | ○ |
| | | | Class II | $C < 10\mu F$ | ○ | ○ |
| | | | | $C \geq 10\mu F$ | - | ○ |
| | | | Array | - | - | ○ |
| | | 1210 (3225) | - | - | - | ○ |
| | | 1808 (4520) | | | | ○ |
| 1812 (4532) | ○ | | | | | |
| 2220 (5750) | ○ | | | | | |

Note1. Initial Measurement For Class II

Perform the heat treatment at 150°C±0/-10°C for 1 hour. Then Leave the capacitor in ambient condition for 48±4 hours before measurement. Then perform the measurement.

Note2. Latter Measurement

1. CLASS I

Leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.

2. Class II

Perform the heat treatment at 150°C±0/-10°C for 1 hour. Then Leave the capacitor in ambient condition for 48±4 hours before measurement. Then perform the measurement.

*Table1.

| Tan δ | 0.125max* |
|---------------------------------------|------------------|
| Class II A(X5R), B(X7R) | 0201 C ≥ 0.022μF |
| | 0402 C ≥ 0.22μF |
| | 0603 C ≥ 2.2μF |
| | 0805 C ≥ 4.7μF |
| | 1206 C ≥ 10.0μF |
| | 1210 C ≥ 22.0μF |
| | 1812 C ≥ 47.0μF |
| | 2220 C ≥ 100.0μF |
| All Low Profile Capacitors (P.16). | |

*Table2.

| High Temperature Resistance test | |
|----------------------------------|------------------|
| ΔC (Y5V) | ± 30% |
| Class II F(Y5V) | 0402 C ≥ 0.47μF |
| | 0603 C ≥ 2.2μF |
| | 0805 C ≥ 4.7μF |
| | 1206 C ≥ 10.0μF |
| | 1210 C ≥ 22.0μF |
| | 1812 C ≥ 47.0μF |
| | 2220 C ≥ 100.0μF |

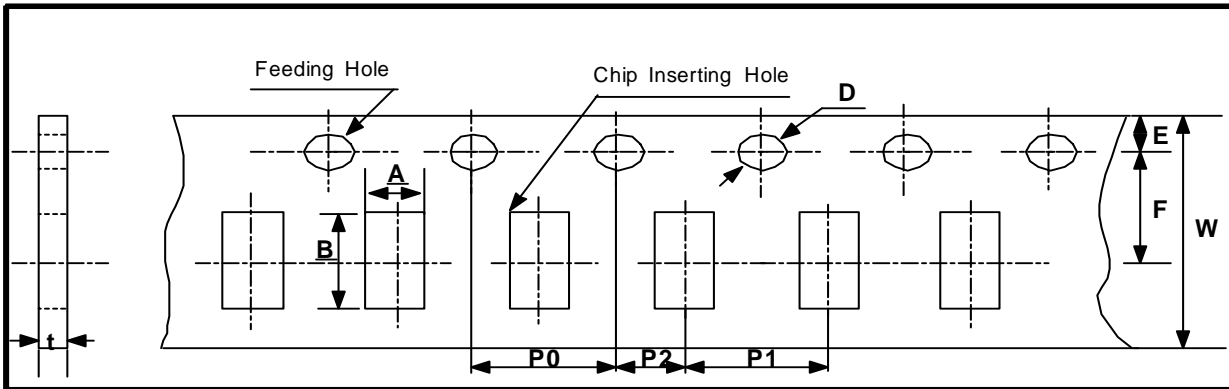
*Table3.

| High Temperature Resistance test | | |
|--|---------------------------|---------------------------|
| Applied Voltage | 100% of the rated voltage | 150% of the rated voltage |
| Class II A(X5R), B(X7R), X(X6S), F(Y5V) All Low Profile Capacitors (P.16). | 0201 C ≥ 0.1μF | 0201 C ≥ 0.022μF |
| | 0402 C ≥ 1.0μF | 0402 C ≥ 0.47μF |
| | 0603 C ≥ 4.7μF | 0603 C ≥ 2.2μF |
| | 0805 C ≥ 22.0μF | 0805 C ≥ 4.7μF |
| | 1206 C ≥ 47.0μF | 1206 C ≥ 10.0μF |
| | 1210 C ≥ 100.0μF | 1210 C ≥ 22.0μF |
| | 1812 C ≥ 47.0μF | 1812 C ≥ 47.0μF |
| | 2220 C ≥ 100.0μF | 2220 C ≥ 100.0μF |

Note3. All Size In Reliability Test Condition Section is "inch"

PACKAGING

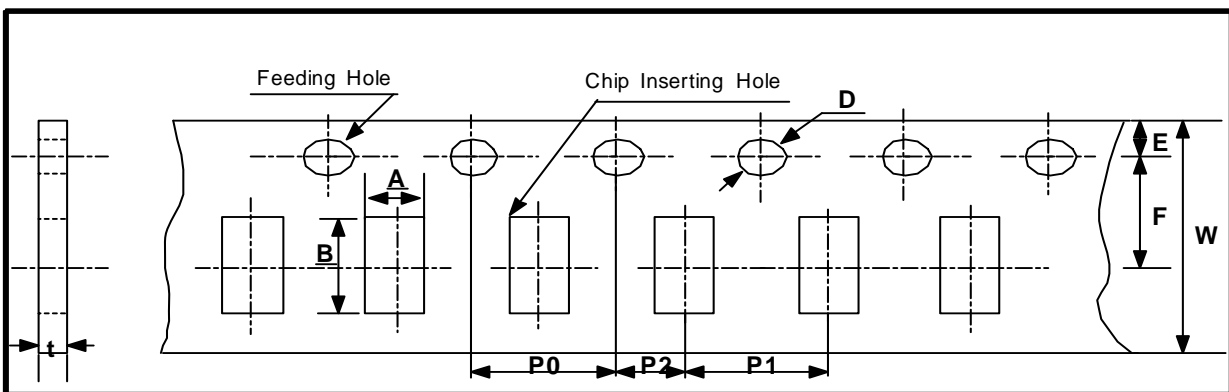
● CARDBOARD PAPER TAPE (4mm)



unit : mm

| Symbol Type | | A | B | W | F | E | P1 | P2 | P0 | D | t |
|-------------|-------------|-------------|-------------|-------------|--------------|--------------|-------------|--------------|-------------|-----------------|--------------|
| Dimension | 0603 (1608) | 1.1 ±0.2 | 1.9 ±0.2 | 8.0 ±0.3 | 3.5 ±0.05 | 1.75 ±0.1 | 4.0 ±0.1 | 2.0 ±0.05 | 4.0 ±0.1 | Φ1.5 +0.1/-0 | 1.1 Below |
| | 0805 (2012) | 1.6 ±0.2 | 2.4 ±0.2 | | | | | | | | |
| | 1206 (3216) | 2.0 ±0.2 | 3.6 ±0.2 | | | | | | | | |

● CARDBOARD PAPER TAPE (2mm)

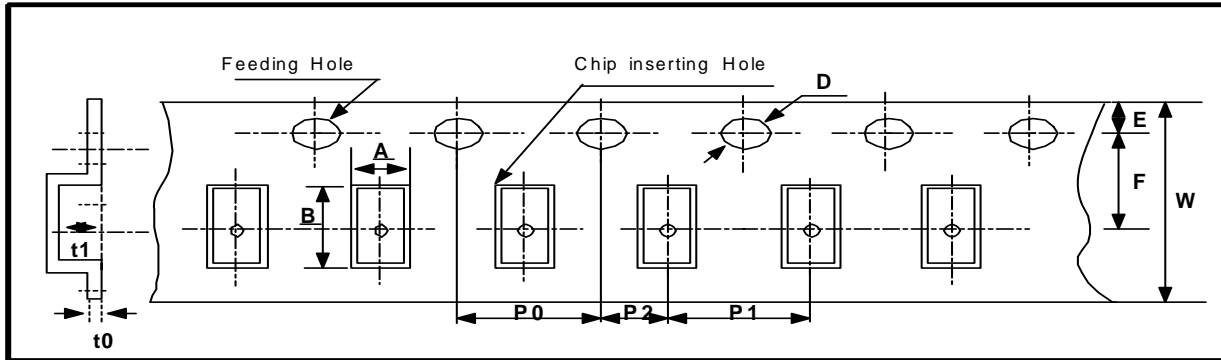


unit : mm

| Symbol Type | | A | B | W | F | E | P1 | P2 | P0 | D | t |
|-------------|-------------|---------------|---------------|-------------|--------------|--------------|--------------|--------------|-------------|--------------------|---------------|
| Dimension | 0201 (0603) | 0.38 ±0.03 | 0.68 ±0.03 | 8.0 ±0.3 | 3.5 ±0.05 | 1.75 ±0.1 | 2.0 ±0.05 | 2.0 ±0.05 | 4.0 ±0.1 | Φ1.5 +0.1/-0.03 | 0.37 ±0.03 |
| | 0402 (1005) | 0.62 ±0.04 | 1.12 ±0.04 | | | | | | | | 0.6 ±0.05 |

PACKAGING

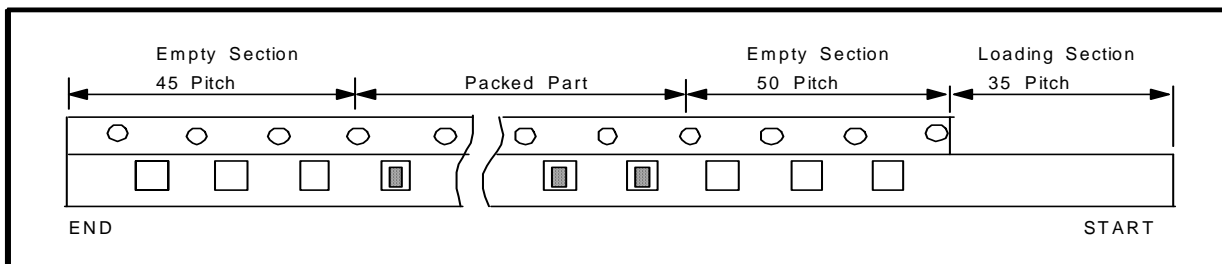
EMBOSSED PLASTIC TAPE



unit : mm

| Symbol Type | A | B | W | F | E | P1 | P2 | P0 | D | t1 | t0 |
|-------------|-------------|-----------|----------|-----------|------------|----------|-----------|----------|--------------|---------|-----------|
| Dimension | 0805 (2012) | 1.45 ±0.2 | 2.3 ±0.2 | 8.0 ±0.3 | 3.5 ±0.05 | 4.0 ±0.1 | 2.0 ±0.05 | 4.0 ±0.1 | Φ1.5 +0.1/-0 | 2.5 max | 0.6 Below |
| | 1206 (3216) | 1.9 ±0.2 | 3.5 ±0.2 | | | | | | | | |
| | 1210 (3225) | 2.9 ±0.2 | 3.7 ±0.2 | | | | | | | | |
| | 1808 (4520) | 2.3 ±0.2 | 4.9 ±0.2 | 12.0 ±0.3 | 5.60 ±0.05 | 8.0 ±0.1 | 3.8 max | | | | |
| | 1812 (4532) | 3.6 ±0.2 | 4.9 ±0.2 | | | | | | | | |
| | 2220 (5750) | 5.5 ±0.2 | 6.2 ±0.2 | | | | | | | | |

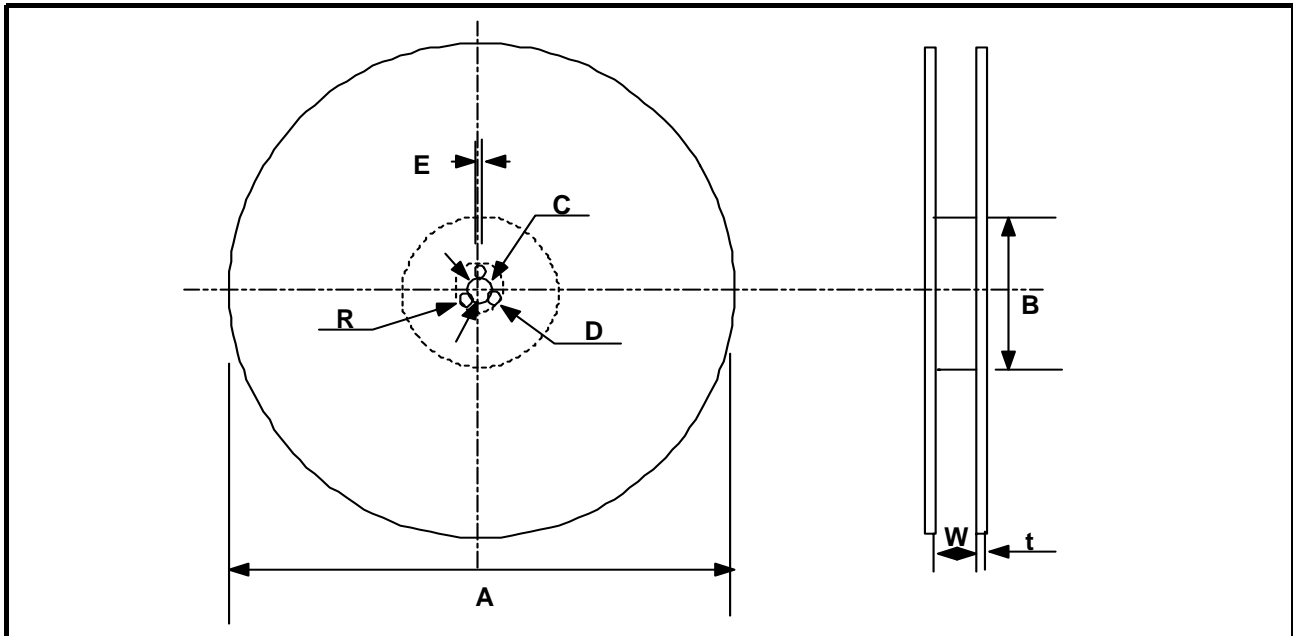
TAPING SIZE



| Type | Symbol | Size | Cardboard Paper Tape | Symbol | Size | Embossed Plastic Tape |
|----------|--------|----------------------------|-----------------------------|--------|---|-----------------------|
| 7" Reel | C | 0201(0603) | 10,000 | E | All Size ≤ 3216 1210(3225),1808(4520) (t ≤ 1.6mm) | 2,000 |
| | | 0402(1005) | 10,000 | | 1210(3225)(t ≥ 2.0mm) | 1,000 |
| | | OTHERS | 4,000 | | 1808(4520)(t ≥ 2.0mm) | 1,000 |
| 10" Reel | O | - | 10,000 | - | - | - |
| 13" Reel | D | 0402(1005) | 50,000 | F | All Size ≤ 3216 1210(3225),1808(4520) (t < 1.6mm) | 10,000 |
| | | OTHERS | 10,000 | | 1210(3225)(1.6 ≤ t < 2.0mm) 1206(3216)(1.6 ≤ t) | 8,000 |
| | L | 0603(1608) | 10,000 or 15,000 | | 1210(3225),1808(4520) (t ≥ 2.0mm) | 4,000 |
| | | 0805(2012) (t ≤ 0.85mm) | 15,000 or 10,000(Option) | | 1812(4532)(t ≤ 2.0mm) | 4,000 |
| | | 1206(3216) (t ≤ 0.85mm) | 10,000 | | 1812(4532)(t > 2.0mm) 5750(2220) | 2,000 |

PACKAGING

● REEL DIMENSION

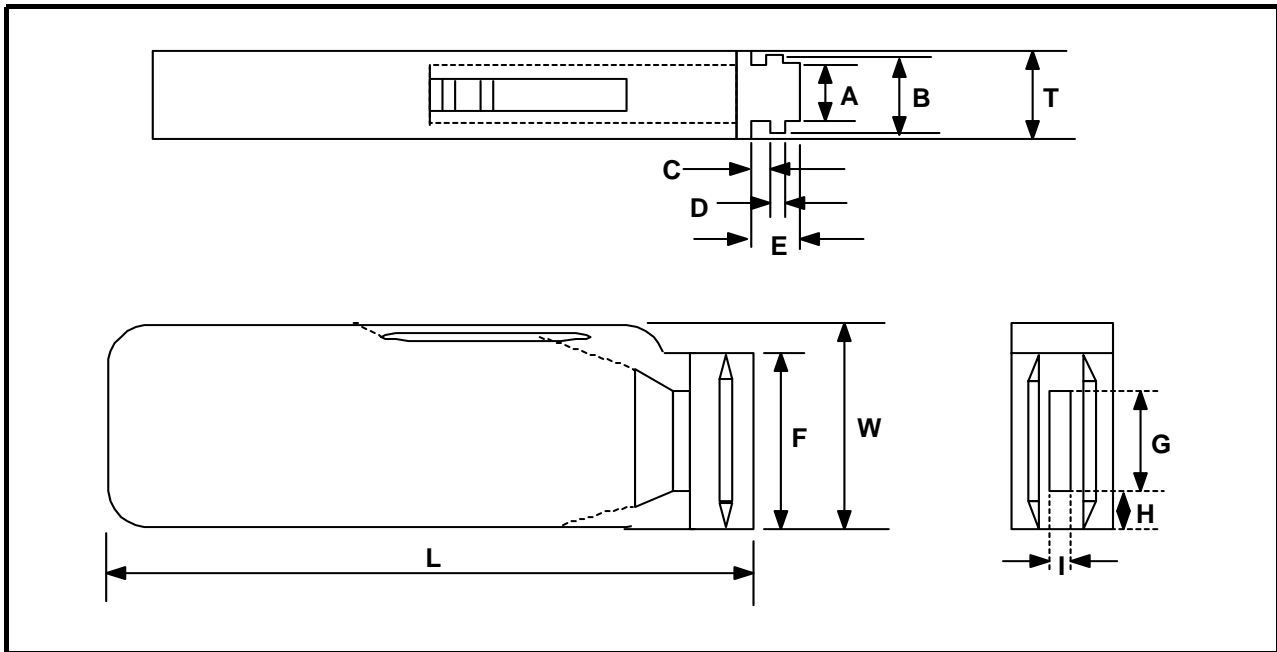


unit : mm

| Symbol | A | B | C | D | E | W | t | R |
|----------|-------------------|-----------------|------------------|-------------|--------------|------------|--------------|-----|
| 7" Reel | $\phi 180+0/ -3$ | $\phi 60+1/ -3$ | $\phi 13\pm 0.3$ | 25 ± 0.5 | 2.0 ± 0.5 | 9 ± 1.5 | 1.2 ± 0.2 | 1.0 |
| 13" Reel | $\phi 330\pm 2.0$ | $\phi 80+1/ -3$ | | | | | 2.2 ± 0.2 | |

● BULK CASE PACKAGING

- Bulk case packaging can reduce the stock space and transportation costs.
- The bulk feeding system can increase the productivity.
- It can eliminate the components loss.



unit : mm

| Symbol | A | B | T | C | D | E |
|-----------|---------------|---------------|--------------|-------------------|-----------------|-------------------|
| Dimension | 6.8 ± 0.1 | 8.8 ± 0.1 | 12 ± 0.1 | $1.5 + 0.1 / - 0$ | $2 + 0 / - 0.1$ | $3.0 + 0.2 / - 0$ |

| Symbol | F | W | G | H | L | I |
|-----------|--------------------|------------------|---------------|--------------|---------------|--------------|
| Dimension | $31.5 + 0.2 / - 0$ | $36 + 0 / - 0.2$ | 19 ± 0.35 | 7 ± 0.35 | 110 ± 0.7 | 5 ± 0.35 |

● QUANTITY OF BULK CASE PACKAGING

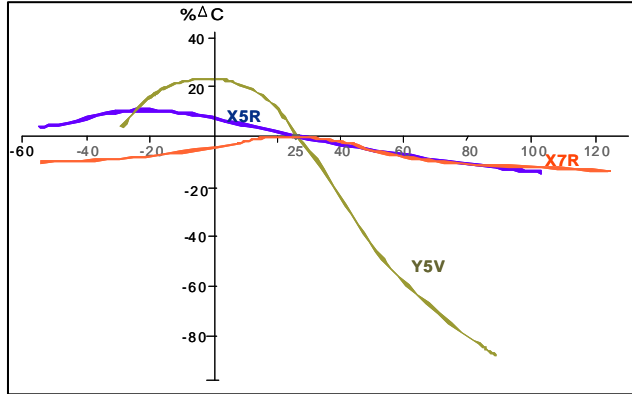
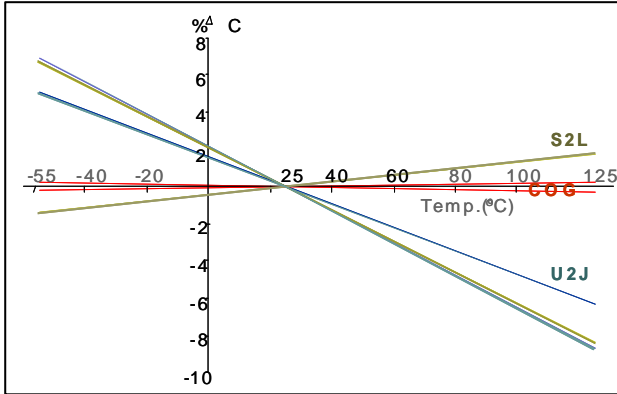
unit : pcs

| Size | 0402(1005) | 0603(1608) | 0805(2012) | |
|----------|------------|------------------|------------|-----------------|
| | | | T=0.65mm | T=0.85mm |
| Quantity | 50,000 | 10,000 or 15,000 | 10,000 | 5,000 or 10,000 |

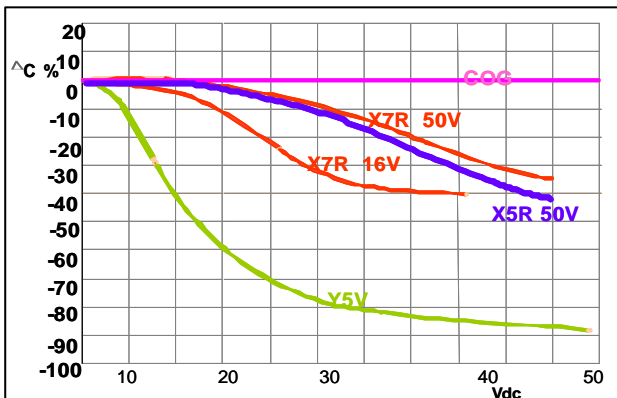
APPLICATION MANUAL

ELECTRICAL CHARACTERISTICS

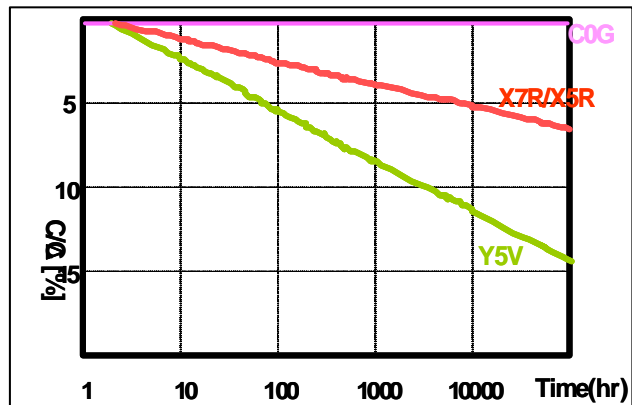
CAPACITANCE - TEMPERATURE CHARACTERISTICS



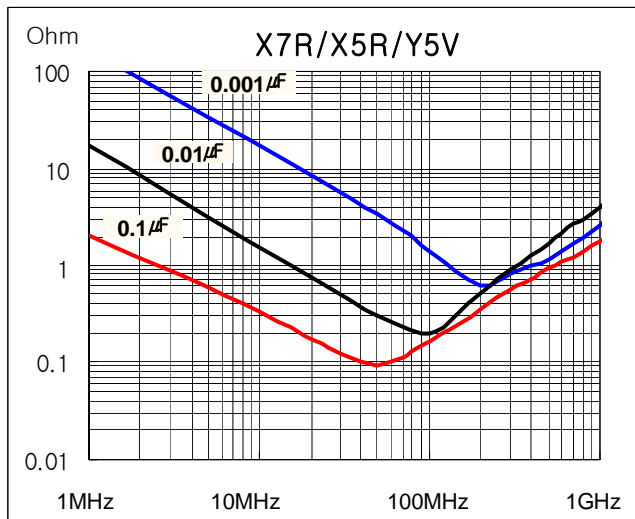
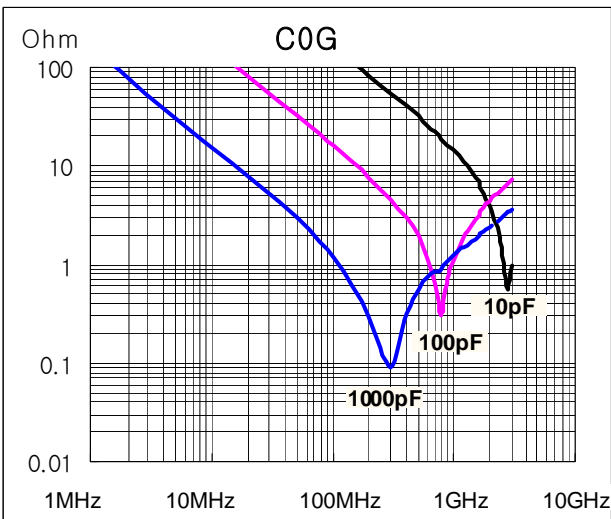
CAPACITANCE - DC VOLTAGE CHARACTERISTICS



CAPACITANCE CHANGE - AGING



IMPEDANCE - FREQUENCY CHARACTERISTICS



General Capacitors

● STORAGE CONDITION

▶ Storage Environment

The electrical characteristics of MLCCs were degraded by the environment of high temperature or humidity. Therefore, the MLCCs shall be stored in the ambient temperature and the relative humidity of less than 40°C and 70%, respectively.

Guaranteed storage period is within 6 months from the outgoing date of delivery.

▶ Corrosive Gases

Since the solderability of the end termination in MLCC was degraded by a chemical atmosphere such as chlorine, acid or sulfide gases, MLCCs must be avoid from these gases.

▶ Temperature Fluctuations

Since dew condensation may occur by the differences in temperature when the MLCCs are taken out of storage, it is important to maintain the temperature-controlled environment.

● DESIGN OF LAND PATTERN

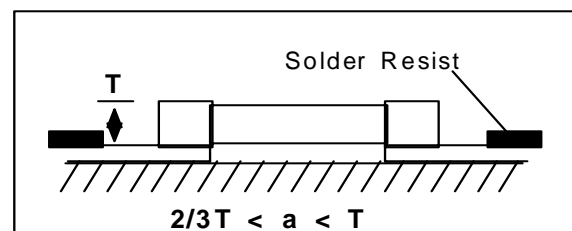
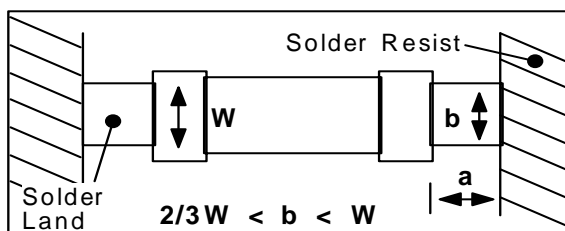
When designing printed circuit boards, the shape and size of the lands must allow for the proper amount of solder on the capacitor.

The amount of solder at the end terminations has a direct effect on the crack.

The crack in MLCC will be easily occurred by the tensile stress which was due to too much amount of solder. In contrast, if too little solder is applied, the termination strength will be insufficiently.

Use the following illustrations as guidelines for proper land design.

Recommendation of Land Shape and Size.



● ADHESIVES

When flow soldering the MLCCs, apply the adhesive in accordance with the following conditions.

▶ Requirements for Adhesives

They must have enough adhesion, so that, the chips will not fall off or move during the handling of the circuit board.

They must maintain their adhesive strength when exposed to soldering temperature.

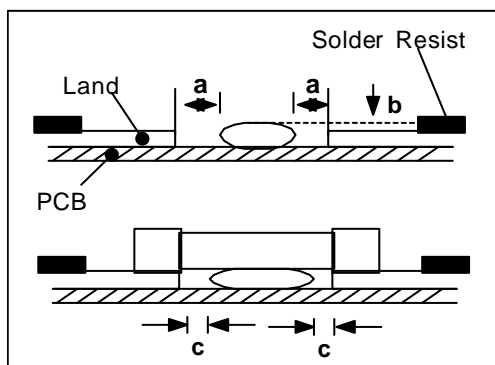
They should not spread or run when applied to the circuit board.

They should harden quickly. They should not corrode the circuit board or chip material.

They should be a good insulator. They should be non-toxic, and not produce harmful gases, nor be harmful when touched.

▶ Application Method

It is important to use the proper amount of adhesive. Too little and much adhesive will cause poor adhesion and overflow into the land, respectively.



unit : mm

| Type | 21 | 31 |
|------|----------------------|----------------------|
| a | 0.2 min | 0.2 min |
| b | 70~100 μm | 70~100 μm |
| c | > 0 | > 0 |

▶ Adhesive hardening Characteristics

To prevent oxidation of the terminations, the adhesive must harden at 160°C or less, within 2 minutes or less.

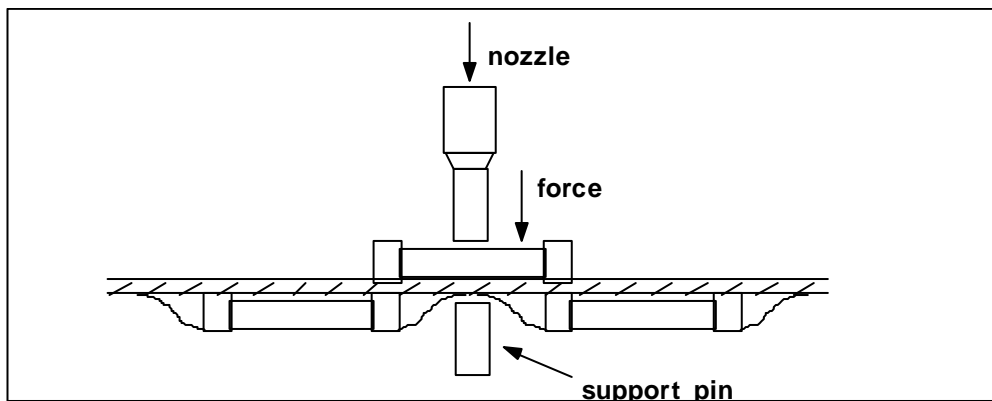
● MOUNTING

▶ Mounting Head Pressure

Excessive pressure will cause crack to MLCCs. The pressure of nozzle will be 300g maximum during mounting.

► Bending Stress

When double-sided circuit boards are used, MLCCs first are mounted and soldered onto one side of the board. When the MLCCs are mounted onto the other side, it is important to support the board as shown in the illustration. If the circuit board is not supported, the crack occur to the ready-installed MLCCs by the bending stress.



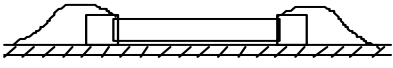
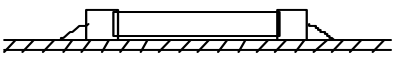
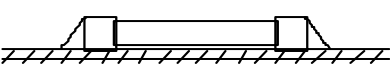
► Manual Soldering

Manual soldering can pose a great risk of creating thermal cracks in chip capacitors.

The hot soldering iron tip comes into direct contact with the end terminations, and operator's carelessness may cause the tip of the soldering iron to come into direct contact with the ceramic body of the capacitor.

Therefore the soldering iron must be handled carefully, and close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.

► Amount of Solder

| | | |
|-------------------|---|--|
| Too much Solder |  | Cracks tend to occur due to large stress |
| Not enough Solder |  | Weak holding force may cause bad connections or detaching of the capacitor |
| Good |  | |

► **Cooling**

Natural cooling using air is recommended. If the chips are dipped into solvent for cleaning, the temperature difference(ΔT) must be less than 100°C

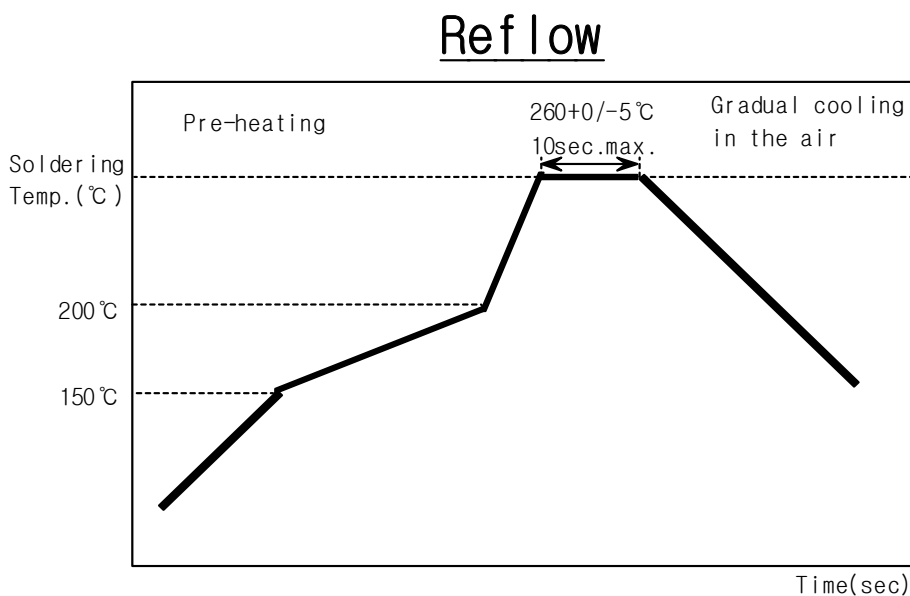
► **Cleaning**

If rosin flux is used, cleaning usually is unnecessary. When strongly activated flux is used, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the chip capacitors. This means that the cleaning fluid must be carefully selected, and should always be new.

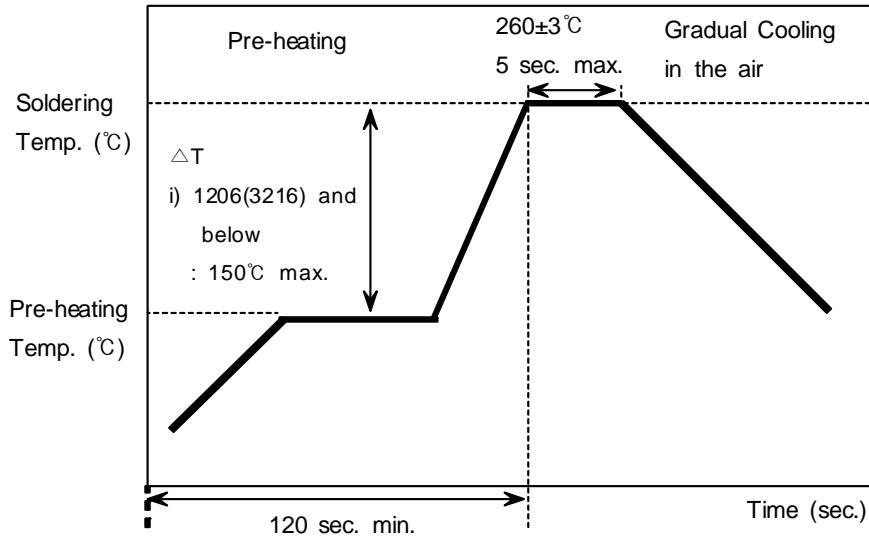
► **Notes for Separating Multiple, Shared PC Boards.**

A multi-PC board is separated into many individual circuit boards after soldering has been completed. If the board is bent or distorted at the time of separation, cracks may occur in the chip capacitors. Carefully choose a separation method that minimizes the bending of the circuit board.

► **Recommended Soldering Profile**



Flow



Soldering Iron

| Variation of Temp. | Soldering Temp (°C) | Pre-heating Time (Sec) | Soldering Time(Sec) | Cooling Time(Sec) |
|---------------------|---------------------------------|------------------------|---------------------|-------------------|
| $\Delta T \leq 130$ | $300 \pm 10^\circ \text{C max}$ | ≥ 60 | ≤ 4 | - |

| Condition of Iron facilities | | |
|------------------------------|--------------|----------------|
| Wattage | Tip Diameter | Soldering Time |
| 20W Max | 3mm Max | 4 Sec Max |

*** Caution - Iron Tip Should Not Contact With Ceramic Body Directly.**