SAMSUNG ELECTRO-MECHANICS

# 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ | ❼ | ❽ | ❾ | ❿ | ⓫ |

❶ Samsung Multilayer Ceramic Capacitor
❷ Size(mm)
❸ Capacitance Temperature Characteristic
❹ Nominal Capacitance
❺ Capacitance Tolerance
❻ Rated Voltage
❼ Thickness Option
❽ Product & Plating Method
❾ Samsung Control Code
❿ Reserved For Future Use
⓫ Packaging Type

### ❶ Samsung Multilayer Ceramic Capacitor

### ❷ 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 |

## ❸ CAPACITANCE TEMPERATURE CHARACTERISTIC

| Code | Temperature Characteristics | | | | Temperature Range |
|---|---|---|---|---|---|
| C | Class Ⅰ | COG | C△ | 0±30(ppm/℃) | -55 ~ +125℃ |
| 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℃ |
| B | | X7R | X7R | ±15% | -55 ~ +125℃ |
| X | | X6S | X6S | ±22% | -55 ~ +105℃ |
| F | | Y5V | Y5V | +22 ~ -82% | -30 ~ +85℃ |

※ **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/℃, H : ±60PPM/℃, G : ±30PPM/℃

## ❹ 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, 0.01μF |
| 104 | 100,000pF, 100nF, 0.1μF |

## ❺ CAPACITANCE TOLERANCE

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

## ❻ 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 | | |

## ❼ 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 | | | |

## ❽ PRODUCT & PLATING METHOD

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

## ❾ 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 |

General Capacitors

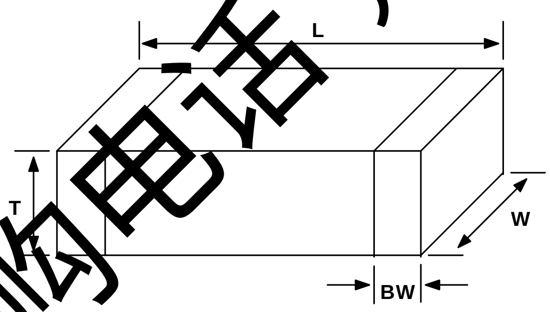
## ⑩ RESERVED FOR FUTURE USE

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

## ⑪ 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 |

# RELIABILTY TEST CONDITION

| NO | ITEM | | PERFORMANCE | TEST CONDITION |
|---|---|---|---|---|
| 1 | Appearance | | No Abnormal Exterior Appearance | Through Microscope(×10) |
| 2 | Insulation Resistance | | 10,000MΩ or 500MΩ·μF whichever is smaller<br>Rated Voltage is below 16V ;<br>10,000MΩ or 100MΩ·μF 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.<br>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 | see Test Condition table 4 (Class I) |
| | | Class II | Within the specified tolerance | see Test Condition table 4 (Class II) |
| 5 | Q | Class I | Capacitance ≥ 30pF : Q ≥ 1,000<br>< 30pF : Q ≥ 400 +20C<br>( C : Capacitance ) | see Test Condition table 5 |
| 6 | Tan δ | Class II | see Performance tables 6 | see Test Condition table 6 |

Test Condition – 4, Class I:

| Capacitance | Frequency | Voltage |
|---|---|---|
| ≤ 1,000pF | 1MHz ±10% | 0.5 ~ 5 Vrms |
| >1,000pF | 1kHz ±10% | |

Test Condition – 4, Class II:

| Capacitance | Frequency | Voltage |
|---|---|---|
| ≤ 10μF | 1kHz ±10% | 1.0±0.2Vrms |
| >10μF | 120Hz ±20% | 0.5±0.1Vrms |

Test Condition – 5, Class I:

| Capacitance | Frequency | Voltage |
|---|---|---|
| ≤ 1,000pF | 1MHz ±10% | 0.5 ~ 5 Vrms |
| >1,000pF | 1kHz ±10% | |

Test Condition – 6, Class II:

| Capacitance | Frequency | Voltage |
|---|---|---|
| ≤ 10μF | 1kHz ±10% | 1.0±0.2Vrms |
| >10μF | 120Hz ±20% | 0.5±0.1Vrms |

Performance – 6, Class II:

1. Characteristic : A(X5R), B(X7R), X(X6S)

| Rated Voltage | Spec |
|---|---|
| ≥25V | 0.025 max |
| 16V | 0.035 max |
| 10V | 0.05 max |
| 6.3V | 0.05 max/ 0.10max*1 |

2. Characteristic : F(Y5V)

| Rated Voltage | Spec |
|---|---|
| 50V | 0.05 max, 0.07max*2 |
| 35V | 0.07 max |
| 25V | 0.05 max/<br>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 |

*1. 0201 C≥0.022uF, 0402 C≥0.22uF, 0603 C≥2.2uF, 0805 C≥4.7uF, 1206 C≥10uF, 1210 C≥22uF, 1812 C≥47uF, 2220 C≥100uF, All Low Profile Capacitors (P.16).

*2.. 0603 C≥0.47uF, 0805 C≥1uF

*3. 0402 C≥0.033uF, 0603 C>0.1uF
All 0805, 1206 size, 1210 C≤ 6.8uF

*4.. 1210 C>6.8uF

*5.. 0402 C≥0.22uF

*6.. All 1812 size

General Capacitors

# RELIABILTY TEST CONDITION

| NO | ITEM | PERFORMANCE | TEST CONDITION |
|---|---|---|---|
| 7 | Temperature Characteristics of Capacitance | (see below) | (see below) |
| 8 | Adhesive Strength of Termination | No Indication Of Peeling Shall Occur On The Terminal Electrode. | (see below) |
| 9 | Bending Strength | (see below) | (see below) |

## 7 Temperature Characteristics of Capacitance

**PERFORMANCE**

Class Ⅰ

| Characteristics | Temp. Coefficient (PPM/℃) |
|---|---|
| C0G | 0 ± 30 |
| PH | -150 ± 60 |
| RH | -220 ± 60 |
| SH | -330 ± 60 |
| TH | -470 ± 60 |
| UL | -750 ± 120 |
| SL | +350 ~ -1000 |

Class Ⅱ

| Characteristics | Capacitance Change with No Bias |
|---|---|
| A(X5R)/ B(X7R) | ±15% |
| X(X6S) | ±22% |
| F(Y5V) | +22% ~ -82% |

**TEST CONDITION**

Capacitance shall be measured by the steps shown in the following table.

| Step | Temp.(℃) |
|---|---|
| 1 | 25 ± 2 |
| 2 | Min. operating temp. ± 2 |
| 3 | 25 ± 2 |
| 4 | Max. operating temp ± 2 |
| 5 | 25 ± 2 |

(1) Class Ⅰ

Temperature Coefficient shall be calculated from the formula as below.

$$\text{Temp, Coefficient} = \frac{C2 - C1}{C1 \times \triangle T} \times 10^6 \ [\text{ppm/℃}]$$

C1; Capacitance at step 3

C2: Capacitance at 85℃

△T: 60℃(=85℃-25℃)

(2) CLASS Ⅱ

Capacitance Change shall be calculated from the formula as below.

$$\triangle C = \frac{C2 - C1}{C1} \times 100(\%)$$

C1; Capacitance at step 3

C2: Capacitance at step 2 or 4

## 8 Adhesive Strength of Termination

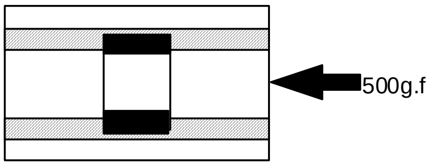
**PERFORMANCE**

No Indication Of Peeling Shall Occur On The Terminal Electrode.

**TEST CONDITION**

Apply 500g.f * Pressure for 10±1 sec.

* 200g.f for 0201 case size.




## 9 Bending Strength

**PERFORMANCE**

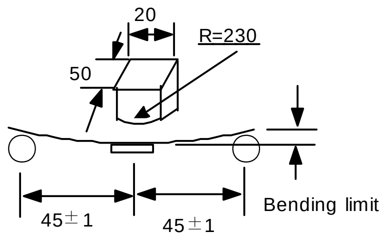
| Item | | | Performance |
|---|---|---|---|
| Appearance | | | No mechanical damage shall occur. |
| Capacitance | Characteristics | | Capacitance Change |
| | Class Ⅰ | | Within ±5% or ±0.5 pF whichever is larger |
| | Class Ⅱ | A(X5R)/ B(X7R)/ X(X6S) | Within ±12.5% |
| | | F(Y5V) | Within ±30% |

**TEST CONDITION**

Bending limit ; 1mm

Test speed ; 1.0mm/SEC.

Keep the test board at the limit point in 5 sec., Then measure capacitance.



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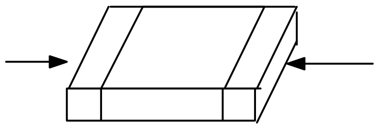
## RELIABILTY TEST CONDITION

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

# RELIABILTY TEST CONDITION

| NO | ITEM | | PERFORMANCE | | | TEST CONDITION |
|---|---|---|---|---|---|---|
| 13 | Humidity (Steady State) | Appearance | No mechanical damage shall occur. | | | Temperature : 40±2 ℃<br>Relative humidity : 90~95 %RH<br>Duration time : 500 +12/-0 hr.<br><br>Leave the capacitor in ambient condition for specified time* before measurement.<br>CLASS Ⅰ : 24±2 Hr.<br>CLASS Ⅱ : 24±2 Hr. |
| | | Capacitance | Characteristics | | Capacitance Change | |
| | | | Class Ⅰ | | Within ±5.0% or ±0.5㎊ whichever is larger | |
| | | | Class Ⅱ | A(X5R)/<br>B(X7R)/<br>X(X6S) | Within ±12.5% | |
| | | | | F(Y5V) | Within ±30% | |
| | | Q<br>CLASS Ⅰ | Capacitance ≥ 30㎊ : Q≥ 350<br>10≤ Capacitance <30㎊ : Q≥ 275 + 2.5×C<br>Capacitance < 10pF : Q≥ 200 + 10×C (C: Capacitance) | | | |
| | | Tan δ<br>CLASS Ⅱ | 1. Characteristic : A(X5R), B(X7R)<br>0.05max (16V and over)<br>0.075max (10V)<br>0.075max<br>(6.3V except Table 1)<br>0.125max*<br>(refer to Table 1) | | 2. Characteristic : F(Y5V)<br>0.075max (25V and over)<br>0.1max (16V, C<1.0㎌)<br>0.125max(16V, C≥1.0㎌)<br>0.15max (10V)<br>0.195max (6.3V) | |
| | | Insulation Resistance | 1,000 ㏁ or 50㏁·㎌ whichever is smaller. | | | |
| 14 | Moisture Resistance | Appearance | No mechanical damage shall occur. | | | Applied Voltage : rated voltage<br>Temperature : 40±2 ℃<br>Humidity : :90~95%RH<br>Duration Time : 500 +12/-0 Hr.<br>Charge/Discharge Current : 50㎃ max.<br><br>Perform the initial measurement according to Note1.<br><br>Perform the final measurement according to Note2. |
| | | Capacitance | Characteristics | | Capacitance Change | |
| | | | Class Ⅰ | | Within ±5.0% or ±0.5㎊ whichever is larger | |
| | | | Class Ⅱ | A(X5R)/<br>B(X7R)/<br>X(X6S) | Within ±12.5%<br>Within ±12.5%<br>Within ±30% | |
| | | | | F(Y5V) | Within ±30%<br>Within ±30% | |
| | | Q<br>(Class Ⅰ) | Capacitance ≥30㎊ : Q≥ 200<br>Capacitance <30㎊ : Q≥ 100 + 10/3×C (C: Capacitance) | | | |
| | | Tan δ<br>(Class Ⅱ) | 1. Characteristic : A(X5R), B(X7R)<br>0.05max (16V and over)<br>0.075max (10V)<br>0.075max<br>(6.3V except Table 1)<br>0.125max*<br>(refer to Table 1) | | 2. Characteristic : F(Y5V)<br>0.075max (25V and over)<br>0.1max (16V, C<1.0㎌)<br>0.125max(16V, C≥1.0㎌)<br>0.15max (10V)<br>0.195max (6.3V) | |
| | | | X(X6S) 0.11max (6.3V and below) | | | |
| | | Insulation Resistance | 500 ㏁ or 25㏁·㎌ whichever is smaller. | | | |

## RELIABILTY TEST CONDITION

| NO | ITEM | | PERFORMANCE | TEST CONDITION |
|---|---|---|---|---|
| 15 | High Temperature Resistance | Appearance | No mechanical damage shall occur. | Applied Voltage : 200%* of the rated voltage<br>Temperature : max. operating temperature<br>Duration Time : 1000 +48/-0 Hr.<br>Charge/Discharge Current : 50㎃ max.<br><br>* refer to table(3) : 150%/100% of the rated voltage<br><br>Perform the initial measurement according to Note1 for Class Ⅱ<br><br>Perform the final measurement according to Note2. |
| | | Capacitance | Characteristics / Capacitance Change<br>Class Ⅰ: Within ±3% or ±0.3㎊, Whichever is larger<br>Class Ⅱ A(X5R)/B(X7R): Within ±12.5%<br>Class Ⅱ X(X6S): Within ±25%<br>Class Ⅱ F(Y5V): Within ±30%<br>Within ±30% | |
| | | Q (Class Ⅰ) | Capacitance ≥30㎊ : Q ≥ 350<br>10≤ Capacitance <30 ㎊ : Q ≥ 275 + 2.5×C<br>Capacitance < 10㎊ :Q ≥200 +10×C (C: Capacitance) | |
| | | Tan δ (Class Ⅱ) | 1. Characteristic : A(X5R), B(X7R)<br>0.05max (16V and over)<br>0.075max (10V)<br>0.075max (6.3V except Table 1)<br>0.125max* (refer to Table 1)<br><br>2. Characteristic : F(Y5V)<br>0.075max (25V and over)<br>0.1max(16V, C<1.0㎌)<br>0.125max(16V, C≥1.0㎌)<br>0.15max (10V)<br>0.195max (6.3V)<br><br>X(X6S) 0.11max (6.3V and below) | |
| | | Insulation Resistance | 1,000 ㏁ or 50㏁·㎌ whichever is smaller. | |
| 16 | Temperature Cycle | Appearance | No mechanical damage shall occur. | Capacitor shall be subjected to 5 cycles.<br>Condition for 1 cycle :<br>Step 1: Min. operating temp.+0/-3, 30 min.<br>Step 2: 25, 2~3 min.<br>Step 3: Max. operating temp.+3/-0, 30 min.<br>Step 4: 25, 2~3 min.<br>(Step / Temp.(℃) / Time(min.))<br><br>Leave the capacitor in ambient condition for specified time* before measurement<br>* 24 ± 2 hours (Class Ⅰ)<br>24 ± 2 hours (Class Ⅱ) |
| | | Capacitance | Characteristics / Capacitance Change<br>Class Ⅰ: Within ±2.5% or ±0.25㎊ Whichever is larger<br>Class Ⅱ A(X5R)/B(X7R)/: Within ±7.5%<br>Class Ⅱ X(X6S): Within ±15%<br>Class Ⅱ F(Y5V): Within ±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 | |

# RELIABILTY TEST CONDITION

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

Note1. Initial Measurement For Class Ⅱ

Perform the heat treatment at 150℃+0/-10℃ 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℃+0/-10℃ 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 ≥ 0.022㎌<br>0402 C ≥ 0.22㎌<br>0603 C ≥ 2.2㎌<br>0805 C ≥ 4.7㎌<br>1206 C ≥ 10.0㎌<br>1210 C ≥ 22.0㎌<br>1812 C ≥ 47.0㎌<br>2220 C ≥ 100.0㎌<br>All Low Profile Capacitors (P.16). |

*Table2.

| High Temperature Resistance test | |
|---|---|
| ⊿C (Y5V) | ± 30% |
| ClassⅡ F(Y5V) | 0402 C ≥ 0.47㎌<br>0603 C ≥ 2.2㎌<br>0805 C ≥ 4.7㎌<br>1206 C ≥ 10.0㎌<br>1210 C ≥ 22.0㎌<br>1812 C ≥ 47.0㎌<br>2220 C ≥ 100.0㎌ |

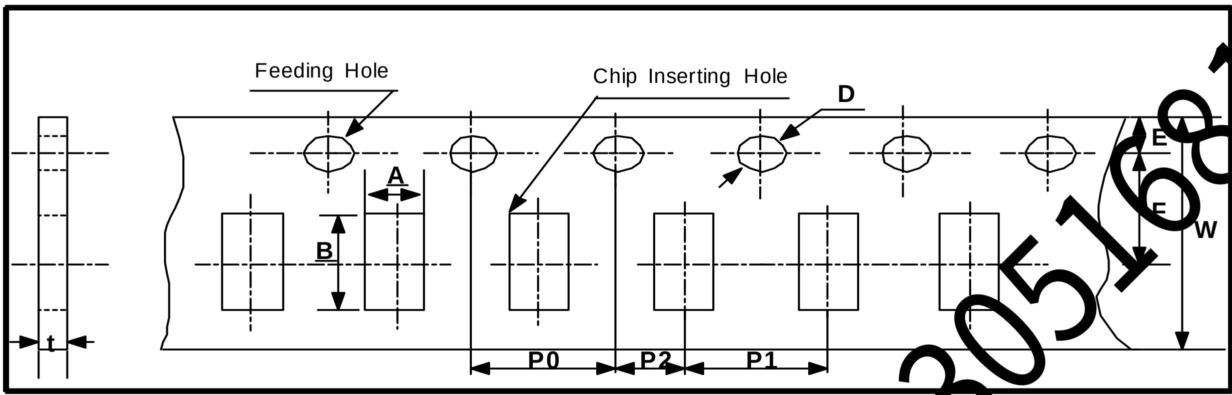
*Table3.

| 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) | 0201 C ≥ 0.1㎌<br>0402 C ≥ 1.0㎌<br>0603 C ≥ 4.7㎌<br>0805 C ≥ 22.0㎌<br>1206 C ≥ 47.0㎌<br>1210 C ≥ 100.0㎌<br>All Low Profile Capacitors (P.16). | 0201 C ≥ 0.022㎌<br>0402 C ≥ 0.47㎌<br>0603 C ≥ 2.2㎌<br>0805 C ≥ 4.7㎌<br>1206 C ≥ 10.0㎌<br>1210 C ≥ 22.0㎌<br>1812 C ≥ 47.0㎌<br>2220 C ≥ 100.0㎌ |

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

# PACKAGING

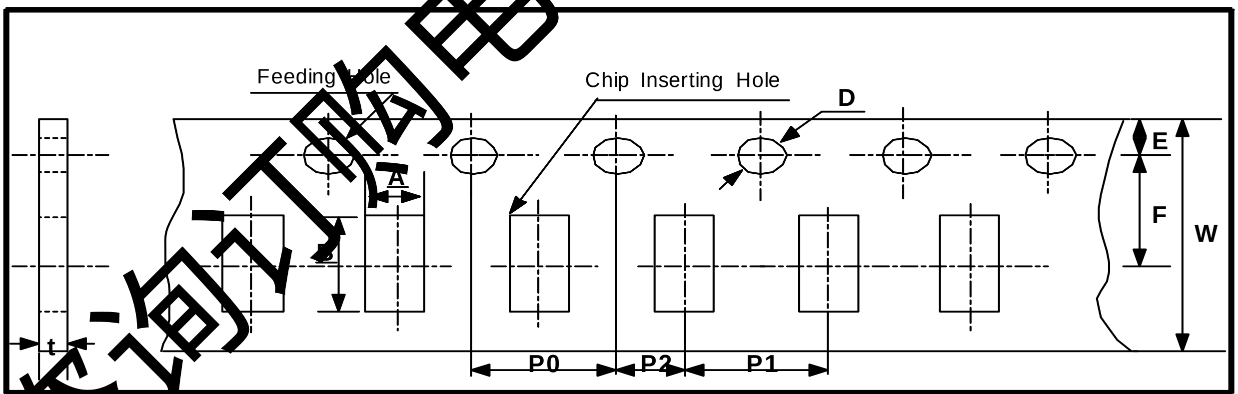
## ● CARDBOARD PAPER TAPE (4mm)




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 | | | | | | | | |
| | 0805 (2012) | 1.6 ±0.2 | 2.4 ±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 |
| | 1206 (3216) | 2.0 ±0.2 | 3.6 ±0.2 | | | | | | | | |

## ● CARDBOARD PAPER TAPE (8mm)

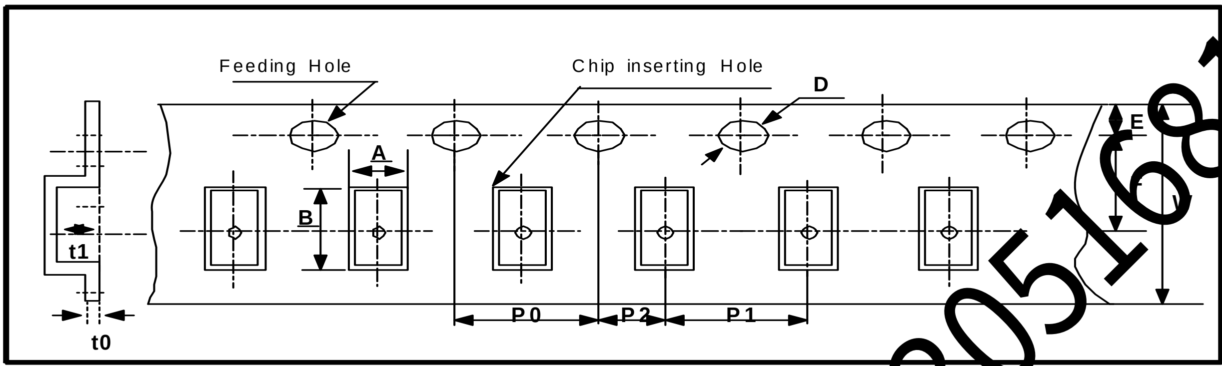



unit : mm

| 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

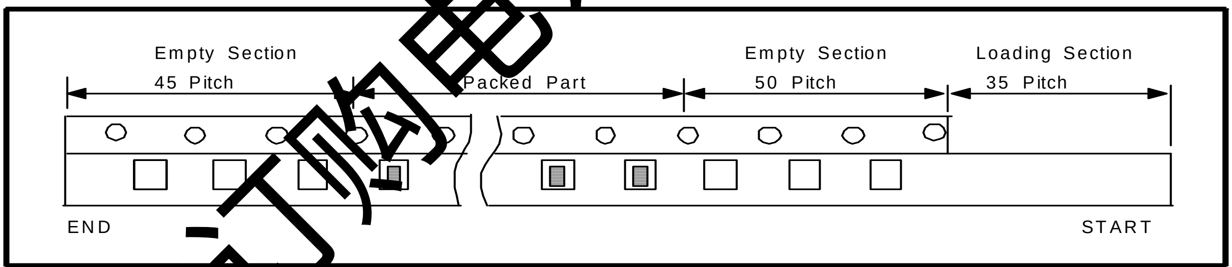
## ● EMBOSSED PLASTIC TAPE




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 | 1.75 ±0.1 | 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

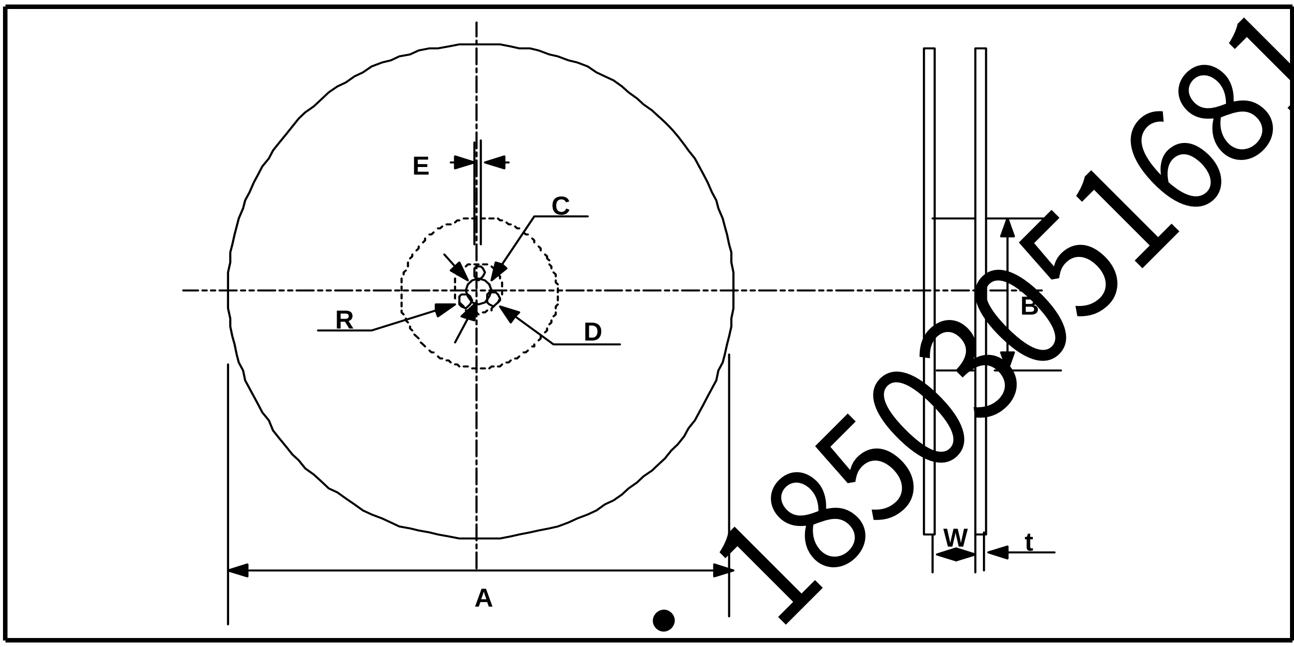



| Type | Symbol | Size | Cardboard Paper Tape | Symbol | Size | Embossed Plastic Tape |
|---|---|---|---|---|---|---|
| 7" Reel | C | 0201(0603) | 10,000 | E | All Size ≤3216 1210(3225),1808(4520) (t≤1.6mm) | 2,000 |
| | | 0402(1005) | 10,000 | | 1210(3225)(t≥2.0mm) | 1,000 |
| | | OTHERS | 4,000 | | 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 |

SAMSUNG ELECTRO-MECHANICS

## PACKAGING

### ● REEL DIMENSION



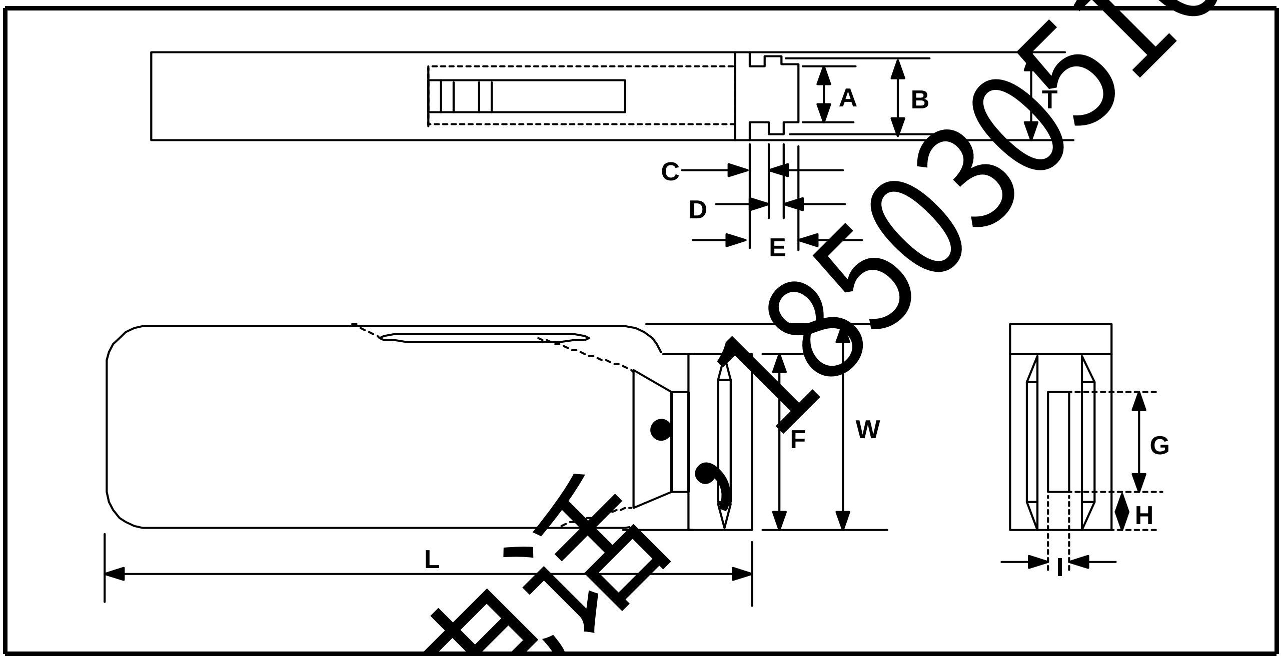

unit : mm

| Symbol | A | B | C | D | E | W | t | R |
|---|---|---|---|---|---|---|---|---|
| **7" Reel** | ϕ180+0/ -3 | ϕ60+1/ -3 | ϕ13±0.3 | 25±0.5 | 2.0±0.5 | 9±1.5 | 1.2±0.2 | 1.0 |
| **13" Reel** | ϕ330±2.0 | ϕ80+1/ -3 | | | | | 2.2±0.2 | |

General Capacitors

## ● 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

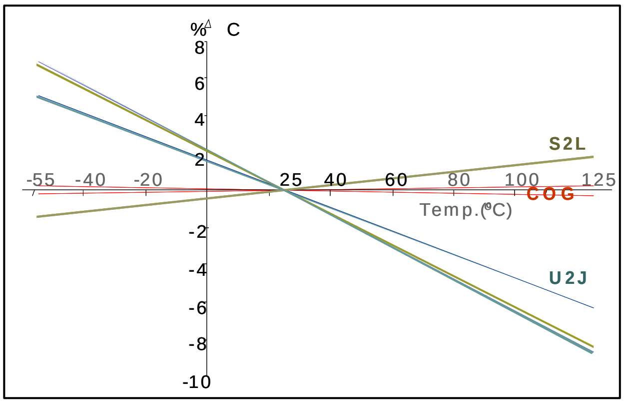
unit : pcs

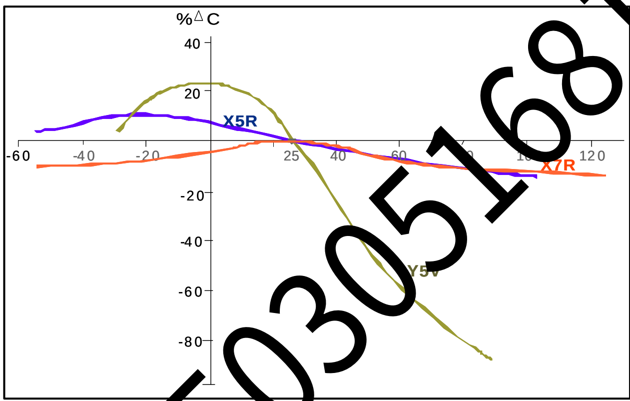
| Size | 0402(1005) | 0603(1608) | 0805(2012) | |
|---|---|---|---|---|
| | | | T=0.65mm | T=0.85mm |
| Quantity | 50,000 | 10,000 or 15,000 | 10,000 | 5,000 or 10,000 |

# APPLICATION MANUAL

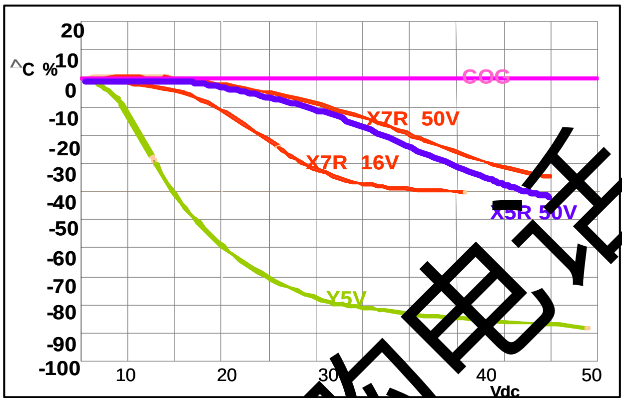
## ● ELECTRICAL CHARACTERISTICS

### ▶ CAPACITANCE - TEMPERATURE CHARACTERISTICS

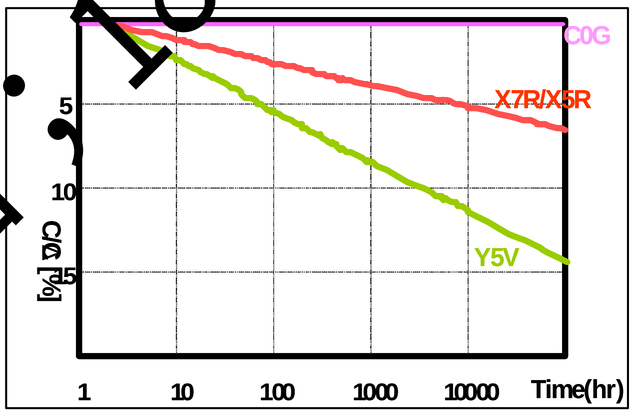


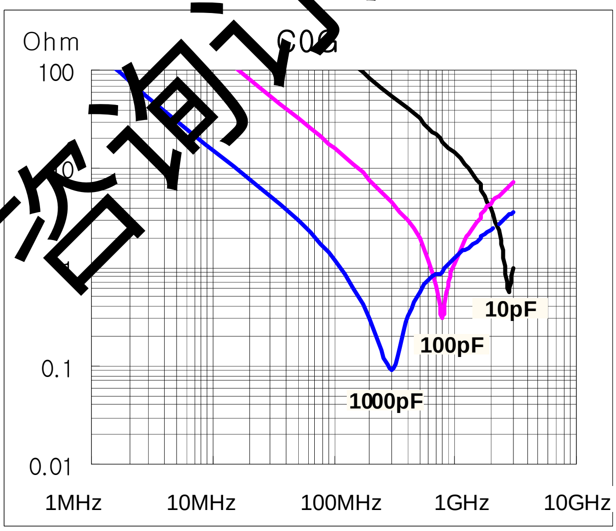

### ▶ CAPACITANCE - DC VOLTAGE CHARACTERISTICS

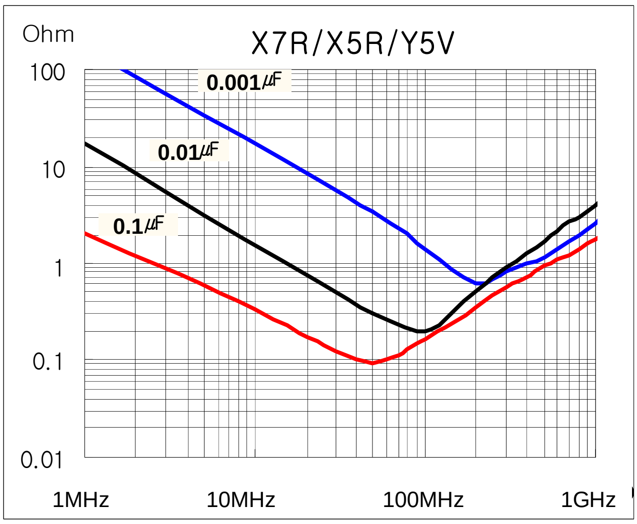



### ▶ CAPACITANCE CHANGE - AGING




### ▶ 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℃ 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

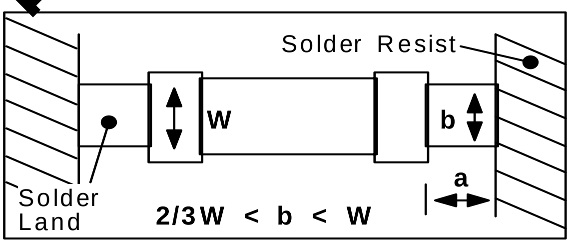
When designing printed circuit boards, the shape and size of the lands must allow for the proper amount of solder on the capacitor.

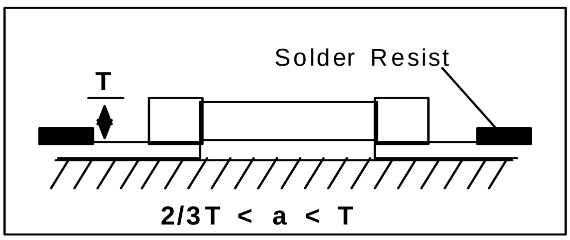
The amount of solder at the end terminations has a direct effect on the crack.

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.

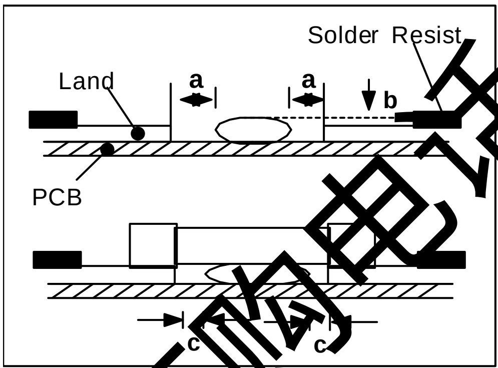
They should not spread or run when applied to the circuit board.

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㎛ | 70~100㎛ |
| c | > 0 | > 0 |

## ▶ Adhesive hardening Characteristics

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

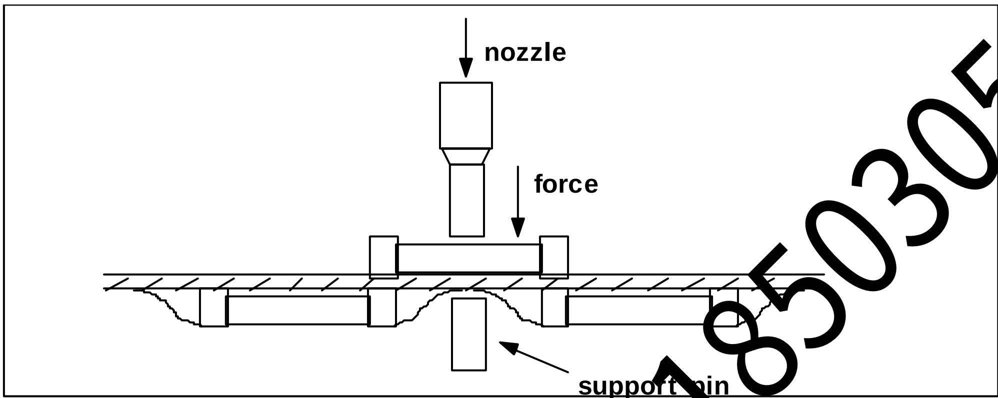
# MOUNTING

## ▶ Mounting Head Pressure

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

## ▶ Bending Stress

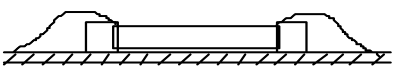
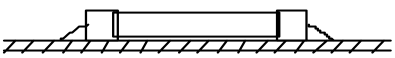
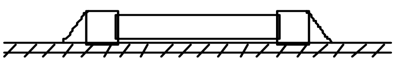
When double-sided circuit boards are used, MLCCs first are mounted and soldered onto one side of the board. When the MLCCs are mounted onto the other side,
it is important to support the board as shown in the illustration. If the circuit board is not supported, the crack occur to the ready-installed 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(△T) must be less than 100℃

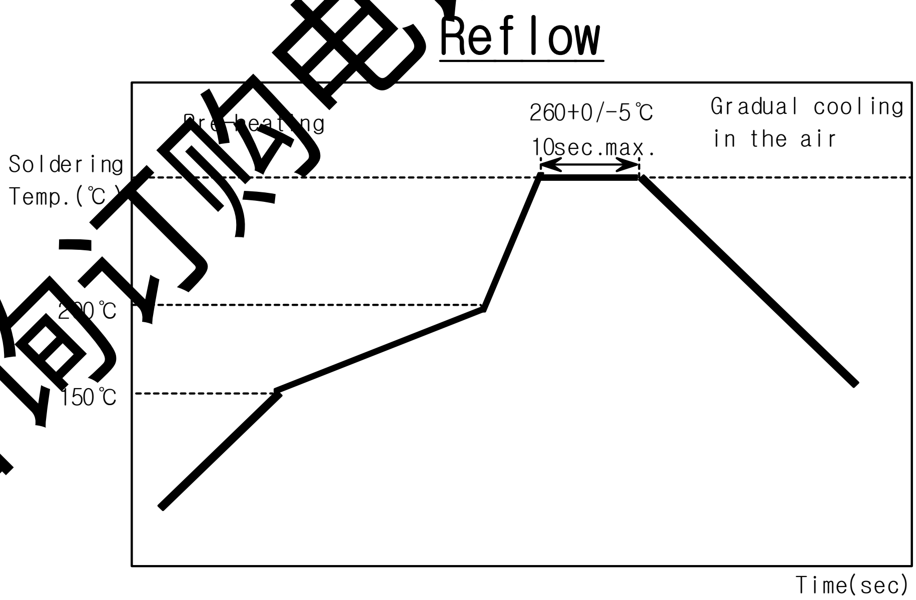
### ▶ Cleaning

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.

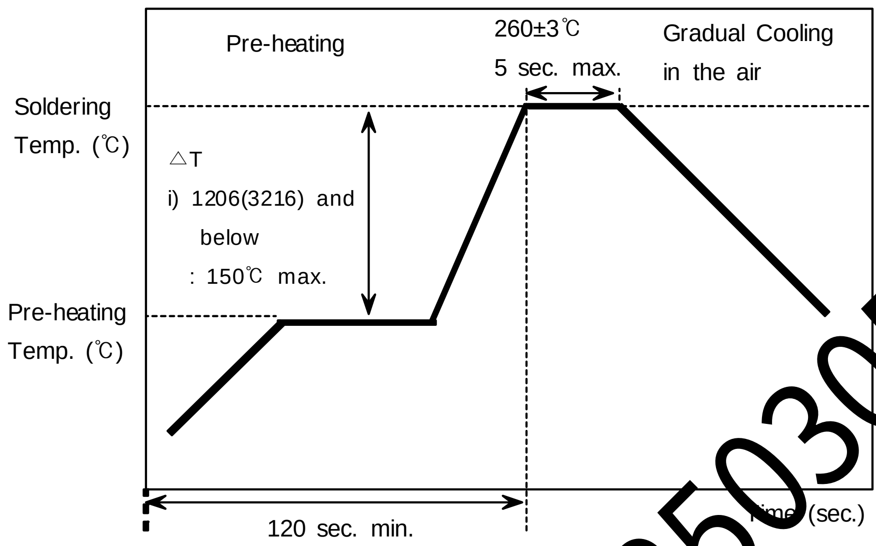
### ▶ Notes for Separating Multiple, Shared PC Boards.

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 (℃) | Pre-heating Time (Sec) | Soldering Time(Sec) | Cooling Time(Sec) |
|---|---|---|---|---|
| △T≤130 | 300±10℃ max | ≥ 60 | ≤ 4 | - |

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

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