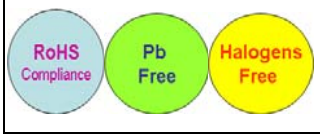
LIPERS
力垣企業股份有限公司
LIPERS ENTERPRISE CO., LTD.

SPECIFICATION FOR APPROVAL

MULTILAYER CERAMIC CHIP CAPACITOR

HIGH VOLTAGE TYPE MLCC



Edition 2018.04

CONTENTS

MULTILAYER CERAMIC CHIP CAPACITOR

********** HIGH VOLTAGE TYPE MLCC **********

FEATURES

- Small case size with high rated voltage , ranging voltage from 100V to 6000V.
- These device are compliant with TUV.

APPLICATIONS

- General telephone exechange.
- Wireless and telecommunication.
- Power device.

1.Product Identification

MH	1812	X	102	K	302	X	G	X
1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9

1-1. **MH** **UWA High Voltage Type MLCC**

1-2. **1812** **Size**

Code	EIA Code	Length * Width mm / (inch)
0603	0603	1.60 * 0.80 / (0.06 * 0.03)
0805	0805	2.00 * 1.25 / (0.08 * 0.05)
1206	1206	3.20 * 1.60 / (0.12 * 0.06)
1210	1210	3.20 * 2.50 / (0.12 * 0.10)
1808	1808	4.50 * 2.00 / (0.18 * 0.08)
1812	1812	4.50 * 3.20 / (0.18 * 0.12)
2220	2220	5.70 * 5.00 / (0.22 * 0.20)
2225		

1-3. **X** **Temperature Characteristic**

Code	Temperature Characteristic	Operation Temperature Range
N	NPO	-55℃ ~ +125℃
X	X7R	-55℃ ~ +125℃
Y	Y5V	-30℃ ~ + 85℃
B	X5R	-55℃ ~ + 85℃
E	Y5U	-30℃ ~ + 85℃
Z	Z5U	+10℃ ~ + 85℃

1-4. **102** **Capacitance**

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	101	100
010	1	102	1,000 (1nF)
100	10	103	10,000 (10nF)

1-5. K Capacitance Tolerance

Code	Tolerance	Nominal Capacitance
B	± 0.1 pF	≦ 10 pF
C	± 0.25 pF	
D	± 0.5 pF	
F	± 1 %	≧ 10 pF
G	± 2 %	
H	± 3 %	
J	± 5 %	
K	± 10 %	
M	± 20 %	
Z	- 20 ~ + 80 %	

1-6. 302 Rated Voltage

Code	Rated Voltage	Code	Rated Voltage
101	100V	202	2000V
201	200V	302	3000V
251	250V	402	4000V
501	500V	502	5000V
102	1000V	602	6000V

1-7. X Quantity

(Unit : pcs)

Code	A	B	T	U	V	W	X	Y	Z			
7〃	15K	10K	4K	3K	2.5K	2K	1K	700	500			
Code	F	G	H	I	J	Code	L	M	N	R	P	Q
13〃	50K	15K	10K	4K	2K	Bulk	5K	10K	20K	50K	100K	200K

1-8. G Thickness

(Unit : mm)

Code	T	A	D	E	F	G
Thickness	0.7±0.1	0.8±0.1	0.85±0.1	1.0±0.1	1.15±0.1	1.25±0.2
Code	H	L	N	Y	M	U
Thickness	1.5±0.2	1.6±0.2	1.9±0.2	2.0±0.2	2.5±0.2	3.2±0.3

1-9. N Material Option

Code	Description Of The Code
N	Sn – Pb Plating (Sn 90% , Pb 10%)
X	Pb – Free Plating (Sn 100%)

2.Standard Combination of Nominal Capacitance and Tolerance

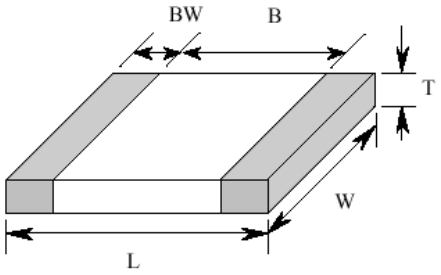
Class	Temperature Characteristic	Tolerance		Nominal Capacitance
Class I	NPO	Less Than 10pF	B(±0.10 pF)	0.5,1,1.5,2,2.5,3
			C(±0.25 pF)	0.5,1,1.5,2,2.5,3,3.5,4,4.5,5
			D(±0.50 pF)	5,6,7,8,9,10
			F(±1.00 pF)	6,7,8,9,10
		More Than 10pF	J(±5%)	E-24 series
			B(±10%)	
Class II	X7R / X5R	K(±10%) , M(±20%)		E-12 series
	Y5V	M(±20%) , Z(-20 ~ +80%)		E- 6 series
	Y5U			
	Z5U			

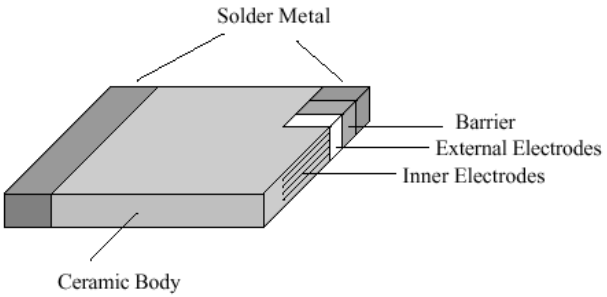
	Application Capacitance											
E-3	1.0				2.2				4.7			
E-6	1.0		1.5		2.2		3.3		4.7		6.8	
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
E-24	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
	1.1	1.3	1.6	2.0	2.4	3.0	3.6	4.3	5.1	6.2	7.5	9.1

3. Dimension & Structure

(Unit : mm)

Code	L	W	T(max)	Bw(min)
0603	1.60±0.10	0.80±0.10	0.95	0.15
0805	2.00±0.20	1.25±0.20	1.40	0.20
1206	3.20±0.30	1.60±0.20	1.80	0.30
1210	3.20±0.30	2.50±0.20	2.70	0.30
1808	4.50±0.30	2.00±0.20	2.20	0.30
1812	4.50±0.30	3.20±0.30	3.30	0.30
2220	5.70±0.40	5.00±0.40	3.00	0.30





4. Capacitance Range - NPO

Temperature Characteristic	Size Code	Rated Voltage	Capacitance Range
CLASS I NPO	0603	100V	680PF
		200V	680PF
		250V	680PF
	0805	100V	3.9NF
		200V	1.2NF
		250V	1.2NF
		500V	560PF
	1206	100V	10NF
		200V	5.6NF
		250V	180PF – 5.6NF
		500V	180PF – 5.6NF
		630V	180PF – 2.2NF
		1KV	10PF – 1NF
		2KV	10PF – 390PF
		3KV	39PF
	1210	100V	10PF – 8.2NF
		250V	47PF – 8.2NF
		500V	47PF – 3.3NF
		630V	47PF – 3.3NF
		1KV	68PF – 2.2NF
	1808	500V	2.2NF
		1KV	1.2NF
		2KV	330PF
		3KV	1NF
		5KV	27PF
	1812	100V	68PF – 8.2NF
		500V	68PF – 8.2NF
		1KV	68PF – 6.8NF
		2KV	68PF – 1.5NF
		3KV	10PF – 1NF
	2220	250V	3.3NF – 27NF
		500V	1NF – 18NF
		5KV	120PF

4-1 Capacitance Range – X7R

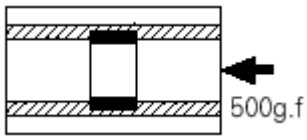
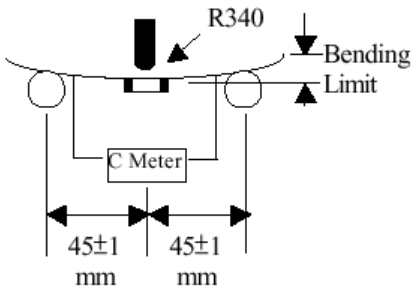
Temperature Characteristic	Size Code	Rated Voltage	Capacitance Range
CLASS II X7R	0603	100V	150PF – 22NF
	0805	100V	100NF
		200V	22NF
		250V	22NF
		500V	10NF
	1206	100V	1UF
		200V	100NF
		250V	100NF
		500V	180PF – 68NF
		630V	220PF – 33NF
		1KV	220PF – 10NF
		2KV	220PF – 1.8NF
	1210	100V	10NF
		200V	10NF – 470NF
		250V	10NF – 470NF
		500V	10NF – 100NF
		1KV	10NF – 22NF
		2KV	220PF – 2.7NF
	1808	500V	2.7NF – 47NF
		1KV	2.7NF – 15NF
		2KV	150PF – 3.3NF
		3KV	150PF – 1.8NF
		4KV	150PF – 1NF
	1812	100V	220PF
		200V	220PF – 1UF
		250V	220PF – 1UF
		500V	220PF – 220NF
		1KV	220PF – 68NF
		2KV	270PF – 10NF
		3KV	680PF – 2.7NF
	2220	200V	100NF
		250V	100NF
		500V	100NF – 470NF
		1KV	10NF – 100NF
		2KV	1NF – 10NF

Note：(1) Other size, capacitance, and voltage are available upon customer's request.

(2) Product range might be extended due to technology improvement or new product released, please contact our sales.

5.Reliability And Test Conditions

<table>
<tr><th>No</th><th>Test Item</th><th>Specifications</th><th>Test Conditions</th></tr>
<tr><td rowspan="4">1</td><td rowspan="2">Capacitance
Class I
NPO</td><td rowspan="2">Within The Specified Tolerance</td><td>Capacitance | Frequency | Signal Voltage</td></tr>
<tr><td>C≦1000 pF | 1MHz ± 10% | 1.0 ± 0.2Vrms
C＞1000 pF | 1KHz ± 10% | 1.0 ± 0.2Vrms</td></tr>
<tr><td rowspan="2">Capacitance
Class II</td><td rowspan="2">Within The Specified Tolerance</td><td>Capacitance | Temp.Char. | Frequency | Rated Voltage
C≦22uF | X7R / X5R X6S / X5S | 1KHz ± 10% | 1.0 ± 0.2Vrms
C≦22uF | X7R / X5R X6S / X5S | 1KHz ± 10% | 1.0 ± 0.2Vrms
C≦22uF | Y5V | 1KHz ± 10% | 0.5 ± 0.2Vrms
C＞22uF | 120HZ ± 20% | 0.5 ± 0.1Vrms</td></tr>
<tr><td rowspan="6">2</td><td>Q
Class I
NPO</td><td>C＞30 pF : Q≧1000
C≦30 pF : Q≧400+20×C
(C:Capacitance , pF)</td><td>Capacitance | Frequency | Signal Voltage
C≦1000 pF | 1MHz ± 10% | 1.0 ± 0.2Vrms
C＞1000 pF | 1KHz ± 10% | 1.0 ± 0.2Vrms</td></tr>
<tr><td rowspan="5">Tan δ
(D.F.)
Class II</td><td>Temp.Char. | HI-V | 50V | 25V | 16V | 10V | 6.3V
X7R / X5R X6S / X5S | 2.5% | 2.5% | 3.5% | 3.5% | 5% | 5%
Y5V | 5% | 5% | 5% | 9% | 12.5% | 16%
ALL
Capacitance | Temp.Char. | Frequency | Signal Voltage
C≦22uF | X7R / X5R X6S / X5S | 1KHz ± 10% | 1.0 ± 0.2Vrms
C≦22uF | Y5V | 1KHz ± 10% | 1.0 ± 0.2Vrms
C＞22uF | 120Hz ± 10% | 0.5 ± 0.1Vrms</td></tr>
<tr><td>Special Parts
X7R / X5R / X6S / X5S
Size | Rated Voltage | Capacitance | Tan δ
0402 | 6.3V | C≧0.22uF | 10% max
0603 | C≧2.2uF
0805 | C≧4.7uF
1206 | C≧10uF
1210 | C≧22uF
1812 | C≧47uF
2220 | C≧100uF
Y5V
Size | Rated Voltage | Capacitance | Tan δ
0402 | 16V | C≧220uF | 12.5% max
0603 | 25~50V | C≧100nF | 7% max
0805 | 25~50V | C≧330nF | 7% max
1206 | 25~50V | C≧1uF | 7% max
1210 | 25V | C≧6.8uF | 9% max
1812 | 10V | C≧10uF | 16% max
2220 | - | - | -</td></tr>
<tr><td>3</td><td>(I.R.)
Insulation Resistance</td><td>Rated Voltage≧25V 10,000 MΩ or 500MΩ ÷ uF
Rated Voltage≦16V 10,000 MΩ or 100 MΩ ÷ uF
Product Whichever Is Smaller</td><td>Vr≦500V Applied Voltage:Rated Voltage
Vr≧500V Applied Voltage:500V
Applied Voltage:Rated Voltage
Charge Time : 60 sec.</td></tr>
<tr><td>4</td><td>Withstanding Voltage</td><td>No Dielectric Breakdown or Mechanical Breakdown</td><td>Vr＜100V Class I:300% of The Rated Voltage
Class II:250% of The Rated Voltage
Vr=100V 250% of The Rated Voltage
200V≦Vr＜500V 200% of The Rated Voltage
500V≦Vr＜1KV 150% of The Rated Voltage
Vr≧1KV 120% of The Rated Voltage
For 1~5 sec. Is Applied Less Than 50mA Current</td></tr>
</table>

<table>
<tr><td>5</td><td>Adhesive Strength Of Termination</td><td colspan="3">No Indication Of Peeling Shall Occur On The Terminal Electrode.</td><td>A 500g..f Push or Pull Force Shall Be Applied For 10 ± 1 Seconds
 
</td></tr>
<tr><td>6</td><td>Resistance To Flexure Of Substrate</td><td colspan="3">No Mechanical Damage Shall Occur.</td><td rowspan="11">Bending Shall Be Applied To The 1.0 mm
With 1.0 mm / sec
 
</td></tr>
<tr><td rowspan="11"></td><td rowspan="11"></td><td rowspan="11">C-Meter</td><td>Temp. Char.</td><td colspan="2">Cap. Change.</td></tr>
<tr><td>NPO</td><td colspan="2">≦± 5 %</td></tr>
<tr><td>X7R / X5R
X6S / X5S</td><td colspan="2">≦± 12.5 %</td></tr>
<tr><td>Y5V</td><td colspan="2" rowspan="3">≦± 30 %</td></tr>
<tr><td>Y5U</td></tr>
<tr><td>Z5U</td></tr>
<tr><td colspan="3">Chip Array Capacitor</td></tr>
<tr><td>NPO</td><td colspan="2">≦± 1 %</td></tr>
<tr><td>X7R</td><td colspan="2" rowspan="2">≦± 10 %</td></tr>
<tr><td>Y5V</td></tr>
<tr><td>7</td><td>Vibration</td><td colspan="4">No Mechanical Damage Shall Be Occur</td><td rowspan="5">Vibrate The Capacitor With Amplitude Of 1.5mm P-P Changing The Frequencies From 10Hz to 55Hz And Back To 10Hz In About 1 min.</td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="2">Temp. Char.</td><td colspan="2">Cap. Change</td></tr>
<tr><td>Class Ⅰ</td><td>NPO</td><td colspan="2">Within±2.5%Or±0.25pF
Whichever
Is Larger</td></tr>
<tr><td rowspan="2">Class Ⅱ</td><td>X7R / X5R
X6S / X5S</td><td colspan="2">Within ± 7.5 %</td></tr>
<tr><td>Y5V/Y5U/Z5U</td><td colspan="2">Within ± 20 %</td></tr>
<tr><td>Q
Class Ⅰ</td><td colspan="4">C＞30 pF : Q ≧1000
C≦30 pF : Q ≧400＋20×C</td></tr>
<tr><td>Tan δ
Class Ⅱ</td><td colspan="4">To Satisfy The Specified Initial Value</td></tr>
<tr><td>Insulation Resistance</td><td colspan="4">To Satisfy The Specified Initial Value</td></tr>
<tr><td>8</td><td>Capacitance Temperatrue Coefficient</td><td rowspan="8">Class II</td><td>Temp.Char.</td><td>Temp. Range</td><td>Cap. Change</td><td rowspan="8">Class I:
$\frac{C2-C1}{C1(T2-T1)} \times 100\%$
Class II :
$\frac{C2-C1}{C1} \times 100\%$
T1:Standard Temperatrue (25°C)
T2:Test Temperature
C1:Capacitance At Standard Temperatrue (25°C)
C2:Capacitance At Test Temperature (T2)</td></tr>
<tr><td>Class I</td><td>Temp.Char.</td><td>Temp. Range</td><td>Cap. Change</td></tr>
<tr><td>NPO</td><td>-55°C~+125°C</td><td>± 30 ppm / °C</td></tr>
<tr><td>X7R</td><td>-55°C~+125°C</td><td>± 15 %</td></tr>
<tr><td>X5R</td><td>-55°C~+85°C</td><td>± 15 %</td></tr>
<tr><td>X5S</td><td>-55°C~+85°C</td><td>± 22 %</td></tr>
<tr><td>X6S</td><td>-55°C~+105°C</td><td>± 22 %</td></tr>
<tr><td>Y5V</td><td>-30°C~+85°C</td><td>+ 22 % ~ - 82 %</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>Y5U</td><td>-30°C~+85°C</td><td>+ 22 % ~ - 56 %</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Z5U</td><td>+10°C~+85°C</td><td>+ 22 % ~ - 56 %</td><td></td></tr>
<tr><td>9</td><td>Solderability</td><td colspan="4">More Than 75% of The Terminal
Surface Is To Be Soldered Newly,
So Metal Part Does Not Come Out Or Dissolve</td><td>Sn / Pb :
Solder Temperature : 230 ± 5 °C
Dip Time : 3 ± 1 sec.
Solder : H63A
Flux : RMA Type
Preheat : At 80~120 °C For 10~30 sec.
Pb Free :
Solder Temperature : 250 ± 5 °C
Dip Time : 3 ±1 sec.
Solder : H63A
Flux : RMA Type
Preheat : At 80~120 °C For 10~30 sec.
Hand Soldering :
Solder Temperature : Sn/Pb 230 ~ 280 °C .
Pb Free 250 ~ 300°C
Use a 20W Soldering Iron And The Soldering Irom Should Not Directly Touch Capacitor.</td></tr>
<tr><td rowspan="7">10</td><td rowspan="7">Resistance To Soldering Heat</td><td colspan="4">No Mechanical Damage Shall Be Occur</td><td rowspan="7">Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at 150+0/-10 °C
before initial measure.

Preheat : At 150±10°C For 60~120sec.
Dip : Solder Temperatrue of 270±5°C
Dip Time : 10±1sec.
Solder : H63A
Flux : Rosin

Measure At Room Temp. After Cooling For:
Class I : 24 ± 2 Hours
Class II : 48 ± 4 Hours</td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="2">Temp. Char.</td><td>Cap. Change</td></tr>
<tr><td>Class I</td><td>NPO</td><td>Within±2.5%Or±2.5pF Whichever Is Larger</td></tr>
<tr><td rowspan="2">Class II</td><td>X7R / X5R
X6S / X5S</td><td>Within ± 10 %</td></tr>
<tr><td>Y5V/Y5U/Z5U</td><td>Within ± 20 %</td></tr>
<tr><td>Q
Class I</td><td colspan="3">C＞30 pF : Q≧1000
C≦30 pF : Q≧400+20×C</td></tr>
<tr><td>Tanδ
Class II</td><td colspan="3">To Satisfy The Specified Initial Value</td></tr>
<tr><td>Insulation Resistance</td><td colspan="3">To Satisfy The Specified Initial Value</td></tr>
<tr><td>Withstand Voltage</td><td colspan="3">To Satisfy The Specified Initial Value</td></tr>
<tr><td rowspan="6">11</td><td rowspan="6">Temperature Cycle</td><td></td><td colspan="3">No Mechanical Damage Shall Be Occur</td><td rowspan="6">Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at 150+0/-10 ℃ before initial measure.
Capacitor Shall Be Subjected To Five Cycles Of The Temperature Cycle As Following:
<table><tr><td>Step</td><td>Temp (°C)</td><td>Time(min)</td></tr><tr><td>1</td><td>Min Rated Temp +0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp +0/-3</td><td>30</td></tr></table></td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="2">Temp. Char.</td><td>Cap. Change</td></tr>
<tr><td>Class I</td><td>NPO</td><td>Within±2.5%Or±0.25 pF Whichever Is Larger</td></tr>
<tr><td rowspan="2">Class II</td><td>X7R / X5R
X6S / X5S</td><td>Within ± 7.5 %</td></tr>
<tr><td>Y5V/Y5U/Z5U</td><td>Within ± 20 %</td></tr>
<tr><td>Q
Class I</td><td colspan="3">C＞30 pF : Q≧1000
C≦30 pF : Q≧400+20×C</td></tr>
</table>

<table>
<tr><td></td><td></td><td>Tan δ
Class II</td><td colspan="8">To Satisfy The Specified Initial Value</td><td colspan="3">4 | 25 | 3
Measure At Room Temp. After Cooling For:
Class I : 24 ± 2 Hours
Class II : 48 ± 4 Hours</td></tr>
<tr><td></td><td></td><td>Insulation Resistance</td><td colspan="8">To Satisfy The Specified Initial Value</td><td></td></tr>
<tr><td rowspan="6">12</td><td rowspan="6">High Temperature</td><td colspan="10">No Mechanical Damage Shall Be Occur</td><td rowspan="6">Class Ⅱ capacitors applied DC voltage is applied for one hour at maximum operation temperature ±3℃ then shall be set for 48 ± 4 hours at room temperature and the initial measurement shall be conducted.

Applied Voltage :
Vr≦200V : 200% Of Rated Voltage
Vr≧250V : 120% Of Rated Voltage
Temperature :Maximum Operation Temperature
Test Time : 1000 ＋48/－0 Hour
Current Applied : 50mA Max.
Measurement Room Temperature
After Cooling For :
Class Ⅰ : 24 ± 2 Hour
Class Ⅱ : 48 ± 4 Hour</td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="3">Temp. Char.</td><td colspan="5">Cap. Change</td></tr>
<tr><td>Class Ⅰ</td><td colspan="2">NPO</td><td colspan="5">Within±3.0% Or ±0.3pF
Whichever Is Larger</td></tr>
<tr><td rowspan="2">Class Ⅱ</td><td colspan="2">X7R / X5R
X6S / X5S</td><td colspan="5">Within ± 15 %</td></tr>
<tr><td colspan="2">Y5V/Y5U/Z5U</td><td colspan="5">Within ± 30 ~ 40 %</td></tr>
<tr><td>Q
Class Ⅰ</td><td colspan="9">C＞30pF : Q ≧350
10 pF＜C≦30 pF : Q ≧275＋2.5×C
C≦10 pF : Q ≧200＋10×C</td></tr>
<tr><td>Tan δ
Class Ⅱ</td><td>Temp. Char.</td><td>HI-V</td><td>50V</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr>
<tr><td>X7R / X5R
X6S / X5S</td><td>5%</td><td>5%</td><td>7%</td><td>7%</td><td>10%</td><td>12.5%</td></tr>
<tr><td>Y5V</td><td>7.5%</td><td>7.5%</td><td>10.5%</td><td>12.5%</td><td>15%</td><td>20%</td></tr>
<tr><td>Y5U / Z5U</td><td>5%</td><td>6%</td><td>10.5%</td><td>10.5%</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">13</td><td rowspan="6">Humidity</td><td colspan="10">No Mechanical Damage Shall Be Occur</td><td rowspan="6">Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at 150+0/-10 °C
before initial measure.

Temperature : 40 ± 2 °C
Relative Humidity : 90 ~ 95 % RH
Test Time : 500+12/-0 Hour
Current Applied : 50mA Max.
Measurement Room Temperature
After Cooling For:
Class I : 24 ± 2 Hours
Class II : 48 ± 4 Hours</td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="3">Temp. Char.</td><td colspan="5">Cap. Change</td></tr>
<tr><td>Class I</td><td colspan="2">(NPO)</td><td colspan="5">Within±5%Or±0.5pF
Whichever
Is Larger</td></tr>
<tr><td rowspan="2">Class II</td><td colspan="2">X7R / X5R</td><td colspan="5">Within ± 15 %</td></tr>
<tr><td colspan="2">Y5V/Y5U/Z5U</td><td colspan="5">Within ± 30 %</td></tr>
<tr><td>Q
Class I</td><td colspan="9">C＞30 pF : Q≧350
10 pF＜C≦30pF : Q≧275+2.5×C
C≦10 pF : Q≧200+10×C</td></tr>
<tr><td>Tan δ
Class II</td><td>Temp. Char.</td><td>HI-V</td><td>50V</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr>
<tr><td>X7R / X5R
X6S / X5S</td><td>2.5%</td><td>5%</td><td>7%</td><td>7%</td><td>10%</td><td>12.5%</td></tr>
<tr><td>Y5V</td><td>7..5%</td><td>7..5%</td><td>10.5%</td><td>12.5%</td><td>15%</td><td>20%</td></tr>
<tr><td>Y5U / Z5U</td><td>5%</td><td>6%</td><td>6%</td><td>6%</td><td>-</td><td>-</td></tr>
</table>

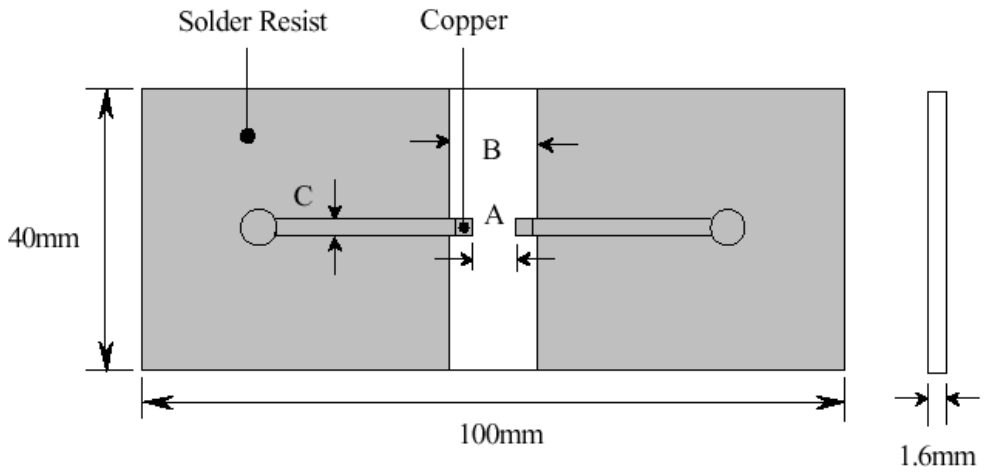
<table>
<tr><td></td><td></td><td>Insulation Resistance</td><td colspan="7">Minimum Insulation Resistance : 1000 MΩ or
50 MΩ ÷uF product whichever is smaller</td><td></td></tr>
<tr><td rowspan="8">14</td><td rowspan="8">Humidity Load</td><td colspan="9">No Mechanical Damage Shall Be Occur</td><td rowspan="8">Class Ⅱ capacitors applied DC voltage of the rated voltage is applied for one hour at maximum operation temperature ±3℃ then shall be set for 48 ± 4 hours at room temperature and the initial measurement shall be conducted

Applied Voltage : Rated Voltage
Temperature : 40 ± 2 ℃
Relative Humidity : 90 ~ 95% RH
Test Time : 500＋12/－0 Hour
Current Applied : 50mA Max.
Measurement Room Temperature
After Cooling For :
Class Ⅰ : 24 ± 2 Hour
Class Ⅱ : 48 ± 4Hour
s</td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="3">Temp. Char.</td><td colspan="5">Cap. Change</td></tr>
<tr><td>Class Ⅰ</td><td colspan="2">NPO</td><td colspan="5">Within±7.5%Or ±0.75pF
Whichever Is Larger</td></tr>
<tr><td rowspan="2">Class Ⅱ</td><td colspan="2">X7R / X5R
X6S / X5S</td><td colspan="5">Within ± 12.5 %</td></tr>
<tr><td colspan="2">Y5V/Y5U/Z5U</td><td colspan="5">Within ± 30 ~ 40 %</td></tr>
<tr><td>Q
Class Ⅰ</td><td colspan="9">C＞30 pF : Q≧350
10 pF＜C≦30 pF : Q≧275＋2.5×C
C≦10 pF : Q≧200＋10×C

Chip Array Capaitor
C＞30 pF : Q≧200
C≦30 pF : Q≧200+10 / 3×C</td></tr>
<tr><td rowspan="4">Tan δ
Class Ⅱ</td><td>Temp. Char.</td><td>HI-V</td><td>50V</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr>
<tr><td>X7R/X5R
X6S / X5S</td><td>2.5%</td><td>5%</td><td>7%</td><td>7%</td><td>10%</td><td>12.5%</td></tr>
<tr><td>Y5V</td><td>7.5%</td><td>7.5%</td><td>10.5%</td><td>12.5%</td><td>15%</td><td>20%</td></tr>
<tr><td>Y5U / Z5U</td><td>5%</td><td>6%</td><td>6%</td><td>6%</td><td>-</td><td>-</td></tr>
<tr><td>Insulation Resistance</td><td colspan="9">Minimum Insulation Resistance:
500MΩ or 25MΩ÷μF
Product Whichever Is Smaller.</td></tr>
<tr><td rowspan="11">15</td><td rowspan="11">Soldering Reference List</td><td rowspan="2">Size</td><td rowspan="2">Char. Temp</td><td rowspan="2">Capacitance</td><td colspan="2">Condition</td></tr>
<tr><td>Reflow</td><td>Flow</td></tr>
<tr><td>0201</td><td>All</td><td>All</td><td>○</td><td>×</td></tr>
<tr><td>0402</td><td>All</td><td>All</td><td>○</td><td>×</td></tr>
<tr><td>0603</td><td>NP0 / X5R / X7R
X6S / X5S</td><td>All</td><td>○</td><td>○</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Y5V</td><td>C＜1uF</td><td>○</td><td>○</td></tr>
<tr><td>C≧1uF</td><td>○</td><td>×</td></tr>
<tr><td>0805</td><td>NP0 / X5R / X7R
X6S / X5S</td><td>All</td><td>○</td><td>○</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Y5V</td><td>C＜4.7uF</td><td>○</td><td>○</td></tr>
<tr><td>C≧4.7uF</td><td>○</td><td>×</td></tr>
<tr><td>1206</td><td>NP0 / X5R / X7R
X6S / X5S</td><td>All</td><td>○</td><td>○</td></tr>
</table>

			Y5V	C＜10uF	○	○
				C≧10uF	○	×
		1210 1808 1812 2220	All	All	○	×

6. P.C. Board for Bending Strength Test



Unit : mm

Code	A	B	C
0201	0.2	1.0	0.3
0402	0.4	1.4	0.5
0603	1.0	3.0	1.0
0805	1.2	4.0	1.6
1206	2.2	5.0	2.0
1210	2.2	5.0	2.9
1808	3.5	7.0	2.5
1812	3.5	7.0	3.7
2220	4.5	8.0	5.6

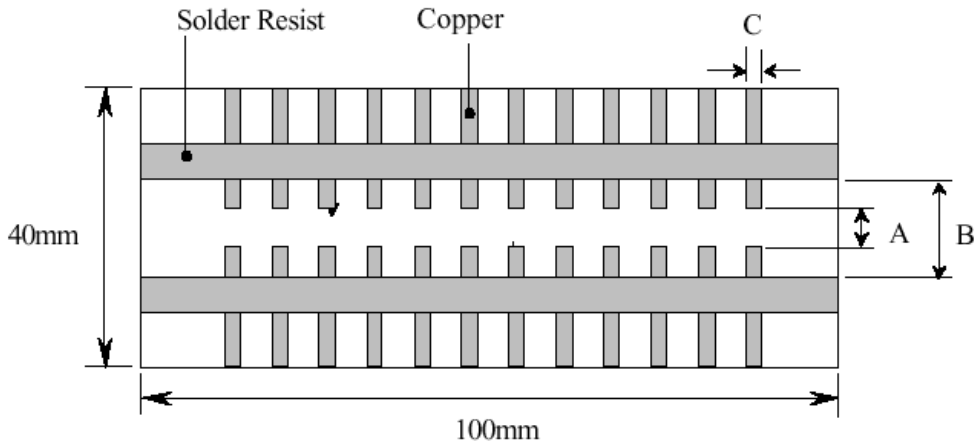
7.Test Substrate

Material: Glass Epoxy Substrate

■ : Copper (Thickness : 0.035mm)

■ : Solder Resist

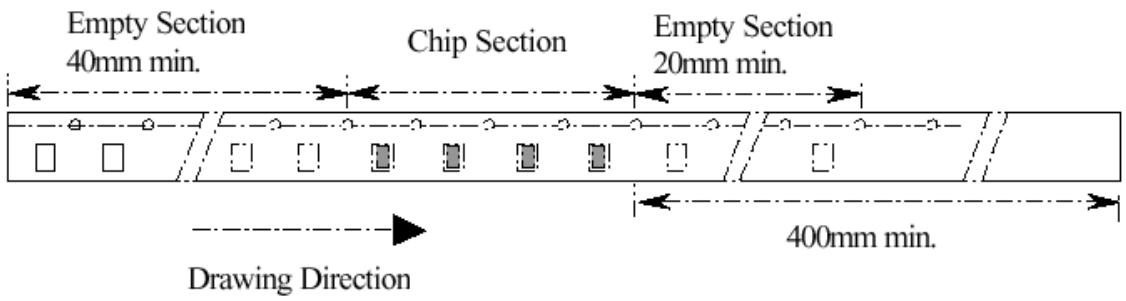
Test Substrate



Unit: mm

Code	A	B	C
0201	0.2	1.0	0.3
0402	0.4	1.4	0.5
0603	1.0	3.0	1.0
0805	1.2	4.0	1.6
1206	2.2	5.0	2.0
1210	2.2	5.0	2.9
1808	3.5	7.0	2.5
1812	3.5	7.0	3.7
2220	4.5	8.0	5.6

8. Packaging

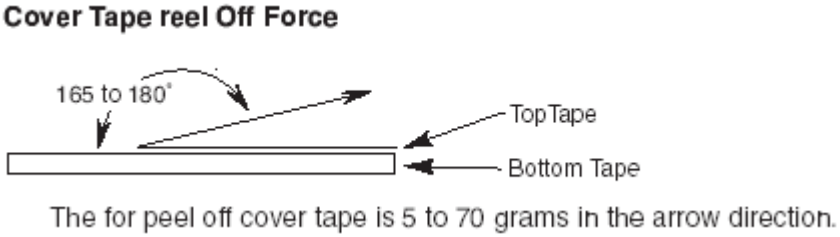


8-3. Material And Quantity

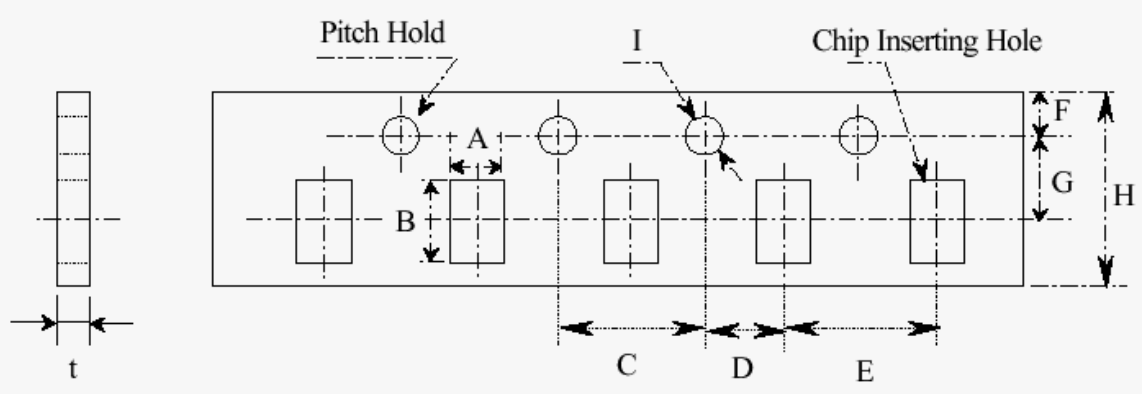
		7〃 Reel		13〃 Reel
Size	Thickness (mm)	Paper Tape	Plastic Tape	Paper / Plastic
0201	T≦0.33	10K / 15K pcs / Reel	-	-
0402	T≦0.55	10K pcs / Reel	-	50K pcs / Reel
0603	T≦0.95	4K pcs / Reel	-	10K / 15K pcs / Reel
0805	T≦0.95	4K pcs / Reel	-	10K / 15K pcs / Reel
	0.95＜T≦1.45	-	3K / 2K pcs / Reel	-
1206	T≦0.95	4K pcs / Reel	-	10K pcs / Reel
	0.95＜T≦1.45	-	3K / 2K pcs / Reel	-
	T＞1.45	-	2K pcs / Reel	-
1210	T≦1.45	-	3K pcs / Reel	10K pcs / Reel
	T＞1.45	-	2K pcs / Reel	4K pcs / Reel
1808	T≦1.45	-	3K pcs / Reel	10K pcs / Reel
	T＞1.45	-	2K pcs / Reel	4K pcs / Reel
1812	T≦2.22	-	1K pcs / Reel	4K pcs / Reel
	T＞2.22	-	500 pcs / Reel	4K pcs / Reel
2220	T≦2.22	-	1K pcs / Reel	2K pcs / Reel
	T＞2.22	-	500 pcs / Reel	2K pcs / Reel

8-1. Cover Tape Reel Off Force

Peel-Off Force : 5 g · f ≦ Peel-Off Force ≦ 70 g · f



8-2. Paper Tape

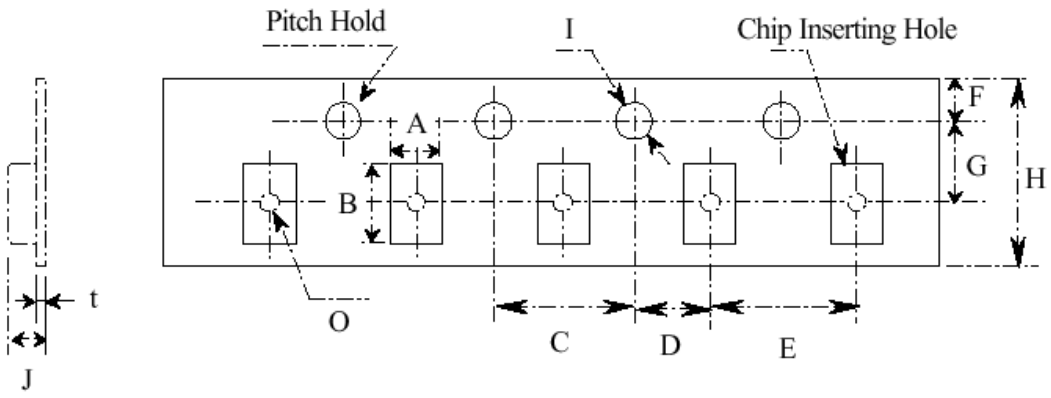


Unit: mm

Code	A	B	C	D	E
0201	0.37±0.03	0.67±0.03	4.0±0.1	2.0±0.05	2.0±0.1
0402	0.61±0.10	1.2±0.1			
0603	1.10±0.20	1.9±0.2			4.0±0.1
0805	1.50±0.20	2.3±0.2			
1206	1.90±0.20	3.5±0.2			
1210	2.90±0.20	3.6±0.2			

Code	F	G	H	I	J
0201	1.75±0.1	3.5±0.05	8.0±0.3	φ1.5+0.1/−0	1.1max
0402					
0603					
0805					
1206					
1210					

8-3. Plastic Tape

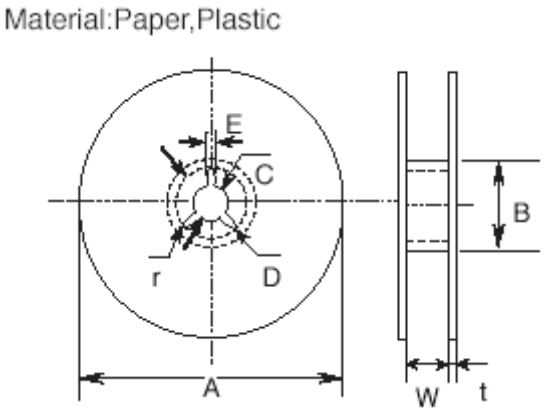


Unit: mm

Code	A	B	C	D	E	F
0805	1.5±0.2	2.3±0.2	4.0±0.1	2.0±0.05	4.0±0.1	1.75±0.1
1206	1.9±0.2	3.5±0.2				
1210	2.9±0.2	3.6±0.2				
1808	2.5±0.2	4.9±0.2				
1812	3.6±0.2	4.9±0.2			8.0±0.1	
2220	5.4±0.2	6.1±0.2				

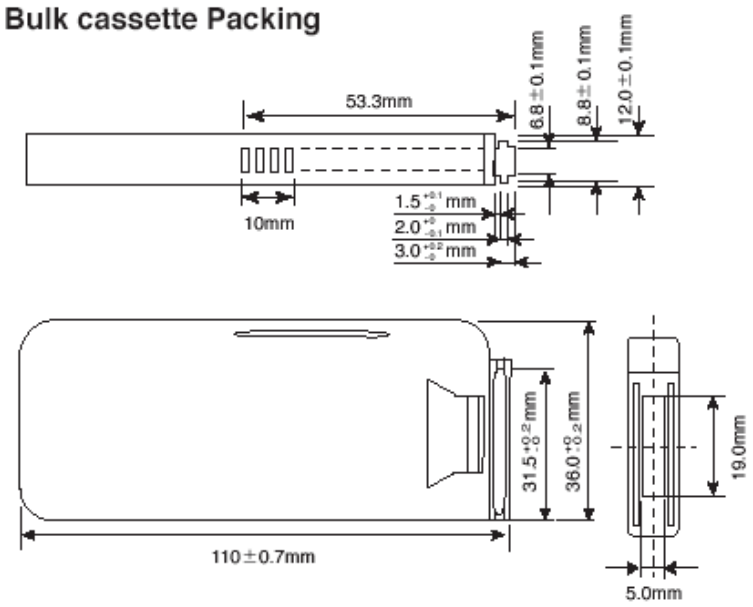
Code	G	H	I	J	t	O
0805	3.5±0.05	8.0±0.3	φ1.5+0.1/−0	3.0 max.	0.3 max.	0.15 min.
1206						
1210						
1808	5.5±0.05	12.0+3/−0		4.0 max.		
1812						
2220						

8-4. Reel Dimensions



	7〃 Reel		13〃 Reel	
Tape Size	8mm	12mm	8mm	12mm
A	178±2		330±2	
B	50±2		60±2	
C	13±0.5		13±0.5	
D	21±1		21±1	
E	2±0.5		2±0.5	
W	10±1.5	14±2	10±1.5	14±2
T	1.5±0.5		2±1	
r	1.0		1.0	

8-5. Bulk Cassette Quantity



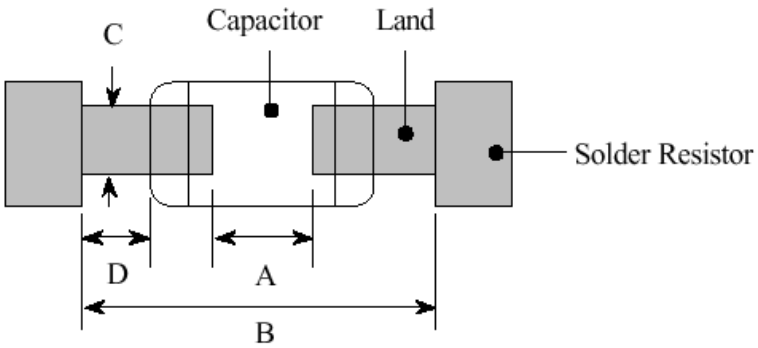
Type	Thickness (mm)	Pcs / Case
0402	0.5	50K
0603	0.8	15K
0805	0.6	10K
	0.85	10K
	1.25	5K

9. Precation Of Usage

9-1.Storage

Store the capacitors where the temperature and relative humidity don't exceed 40°C and 70°RH.
We recommend you use capacitors within 6 months from the manufactured date. In case of packaging, don't the last wrapped, polyethylene bag, till just before using. If it is opened, seal it as soon as possible or keep it in a desiccant with a desicantion agent.

9-2. Size and recommend land dimensions.



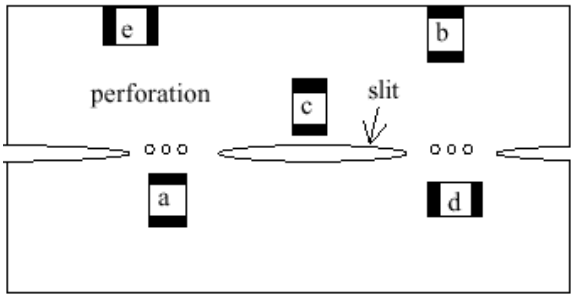
Code	Chip Capacitor		Land			
	L	W	A	B	C	D
0201	0.60	0.30	0.2~0.3	0.9~1.1	0.2~0.3	0.1~0.3
0402	1.00	0.05	0.3~0.5	1.3~1.5	0.3~0.5	0.1~0.3
0603	1.60	0.80	0.6~0.8	1.9~2.1	0.6~0.8	0.2~0.5
0805	2.00	1.25	0.8~1.2	2.4~3.2	0.9~1.2	0.2~0.6
1206	3.20	1.60	1.8~2.5	3.8~4.8	1.2~1.6	0.3~0.8
1210	3.20	2.5	1.9~2.6	3.9~4.9	1.9~2.5	0.3~0.8
1808	4.50	2.00	2.4~3.4	5.4~6.0	1.7~2.0	0.5~1.3
1812	4.50	3.20	2.5~3.5	5.5~6.1	2.3~3.2	0.5~1.3
2220	5.70	5.00	2.7~4.2	6.7~8.3	3.5~5.0	0.5~1.3

Unit : mm

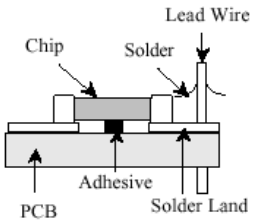
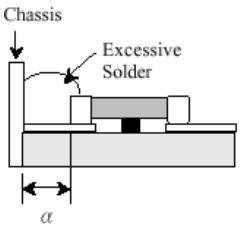
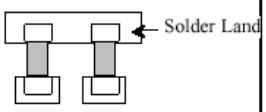
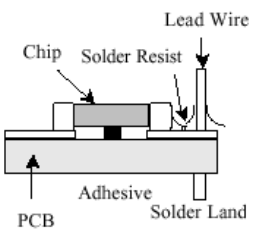
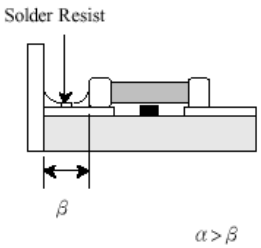
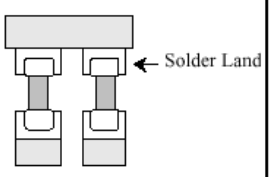
9-3..Mechanical strength varies according to location of chip capacitors the P.C. board.

Design layout of components on the PC board to minimize the stress imposed on the wrap or flexure of the board.
Component layout close to board break

Susceptibility to stress is in the order of : a>b>c≒d>e



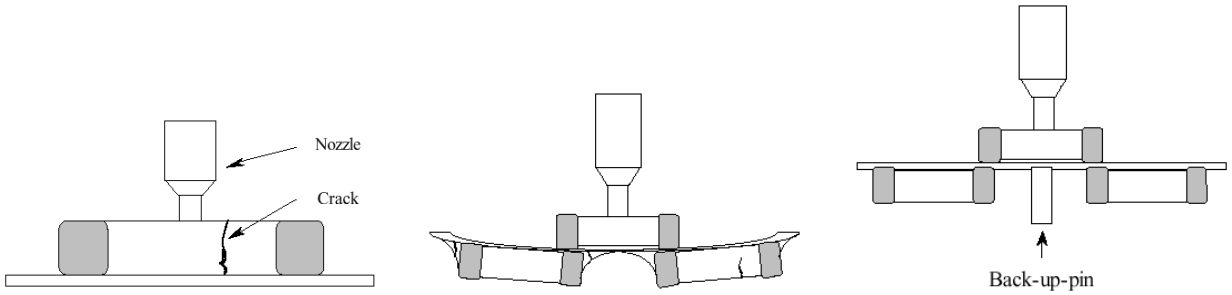
9-4.Layout Recommendation

Example	Use of Common Solder Land	Solder With Chassis	Use of Common Solder Land With Other SMD
Need to Avoid			
Recommendation			

9-5. Mounting

Crack is caused by impact load due to suction nozzle at the mounted.

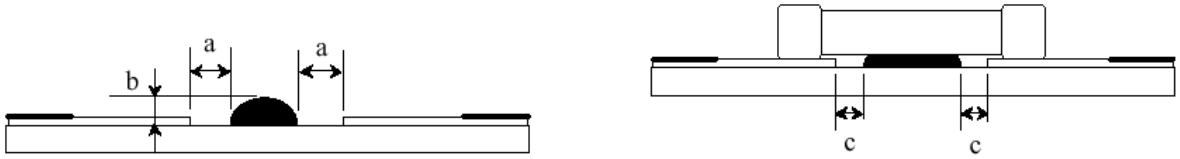
In mounting an element to board, If the low dead point is too low , excessive stress is applied to element. This will cause cracking. In this case, it is required to shift the low dead point of a suction nozzle to the upper surface of board so that warping of board is eliminated. Nozzle pressure is adjusted to 1N to 3N(static load)during mounting.



To Fix Board With Support Pin (OK)

If board is warped during mounting, crack or peeling of soldering will be caused. To avoid this, it is required to fix the board with back up pins or the like to avoid warping. Also, similar precautions are required when inserting a part with lead.

9-6. Amount of Adhesive



Example : 0805 & 1206 Size MLCC	
A	0.2mm (min)
B	70 ~ 100 uM
C	Do Not Touch The Solder Land

9-7.Soldering

9-7-1.Avoiding Thermal Shock

(a) preheat Condition

Carefully perform pre-heating so that the temperature difference (△T)between the solder and component surface should be in the follow range.

Soldering Method	3.2x1.6mm max.	3.2x1.6mm min.
Reflow method	△T≦190°C	△T≦190°C
Immersion method	△T≦150°C	△T≦100°C

(b) Colling Condition

Natural colling using air is recommended. If the chips ard dipped into a solvent for cleaning, the temperature difference (△T)must be less than 100°C

9-7-2. Recommend Soldering Profile By various Methods

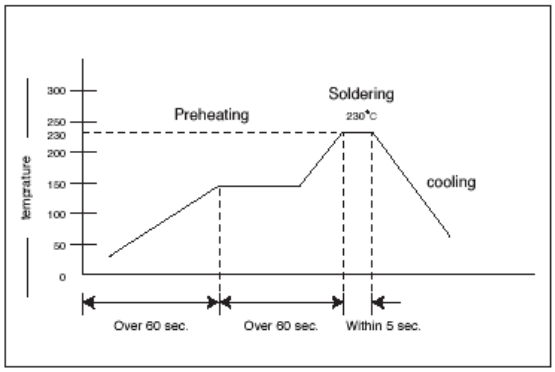
Infrared reflow soldering standard condition Iron/immersion soldering standard condition

9-7-3. Amout of Solder

Excessive solder will induce higher tensile force in chip capacitor when temperature change and it may result in chip cracking. In Sufficient solder may detach the capacitor from the P.C. board.

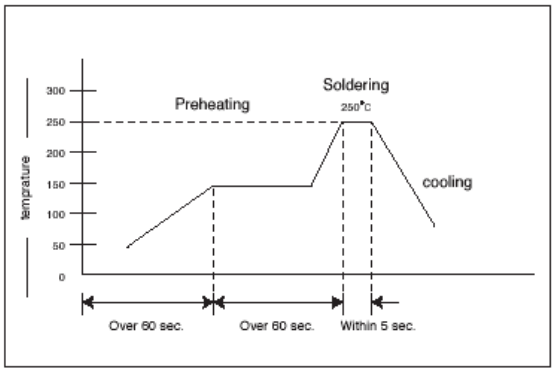
Sn/Pb Plating

Reflow



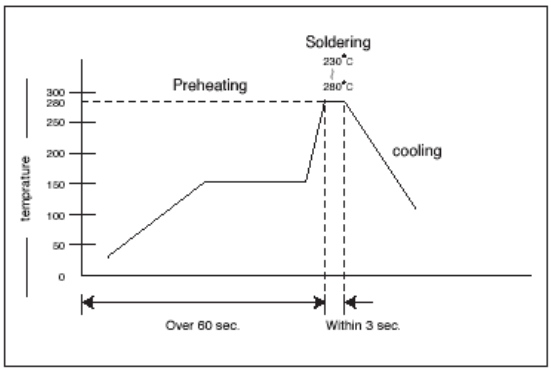
Pb-Free (Sn 100%) Plating

Reflow

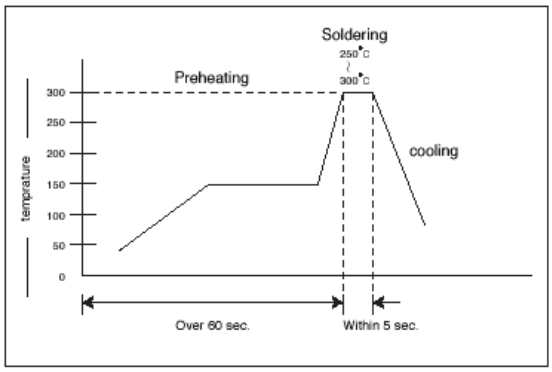


PS: It is suggest the number of Reflow time for all MLCC material : ≦ 3 times .

Solder Iron

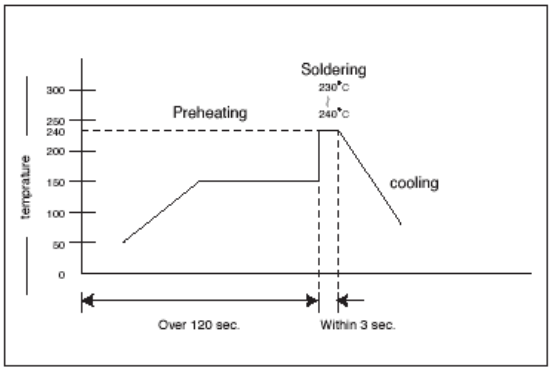


Solder Iron

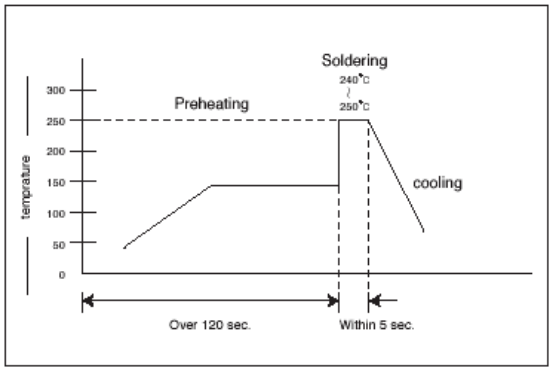


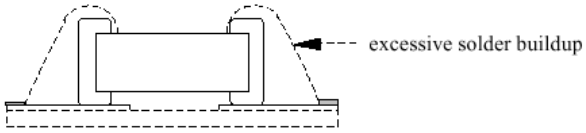
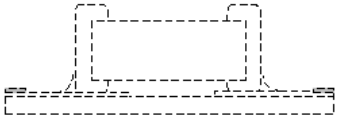
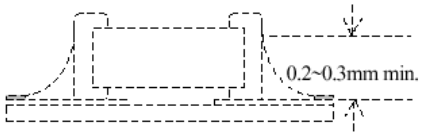
PS:If solder iron temperature about 380 ℃ , at first , to preheat MLCC within 1~3cm distance in radiant heat about 30~60 second , then to heat MLCC within 5seconds by solder iron (300~380 ℃) .

Flow



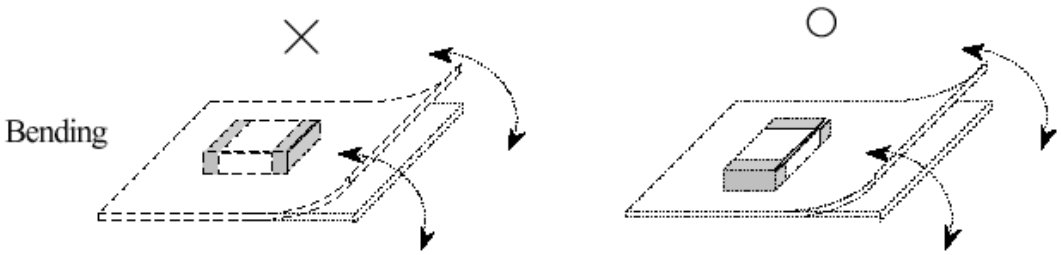
Flow



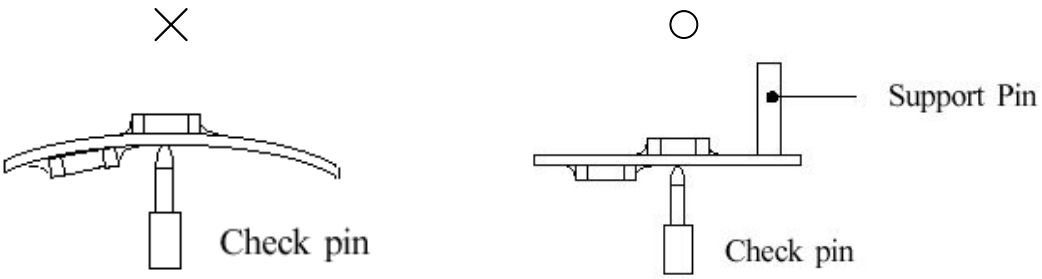
Excessive Solder	
Adequate	
Insufficient Solder	
Solder buildup by Reflow method	

10.Caution : Handing after chip mounted

10-1. Please pay attention put the component lateral to the direction in which stress acts.



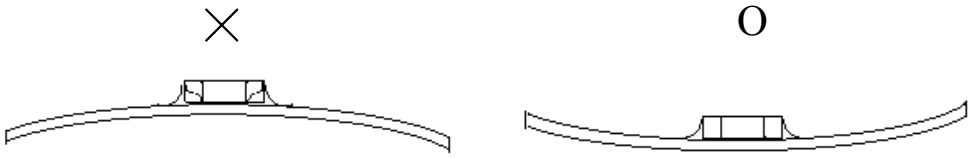
10-2. Crack Will be caused if board is warped due to excessive load by check pin.



10-3. Mechanical stress due to warping and torsion by dividing.

(a) Crack occurrence ratio will be increased by manual separation.

(b) Crack occurrence ratio will be increased by tensile force, rather than compressive force.



10-4. Handing to Loose Chip Capacitor

(a) IF dropped the chip capacitor may crack.

(b)Piling the P.C.board after mounting for storage or handling, the comer of the P.C. board may hit the chip capacitor of another of board to cause crack.

(a) (b)

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