“Military Screening" Grade Two

Multi Layer Ceramic Capacitors

1. Features

- Rectangular, serialized size specifications, suitable for surface mount of hybrid integrated circuits or printed circuits;
- Lead type: radial lead, suitable for plug-in and wave soldering;
- There are a variety of end electrode lead-out materials for Ag (Cu)-Ni-Sn, which are especially suitable for the strict requirements of surface assembly technology for weldability and welding heat resistance.;
- Low inductance, low loss, good frequency characteristics, high reliability;
- National military standard production line production;
- Widely used in military communications, radar, artillery fuzes, ships, ground electronic equipment for aviation, aerospace, and weapon systems, and high-end civilian equipment。
- It is suitable for resonance circuits, coupling circuits and circuits that require low loss, high capacitance, stability and high insulation resistance in various types of military electronic equipment.

Purtnumber structure

FT4-	683	X7R	3838(C1)	K	202	N	T
①	②	③	④	⑤	⑥	⑦	⑧

Description:

① Product series.

FL4: Class I dielectric material type (COG)

FT4: Class II dielectric material type (Other TCC).

② Rated capacity code.

Capacity code	Actual value (pF)	Remark
0R5	0.5pF	The first two digits are valid figures, and the last digit is a power of 10.
1R0	1.0pF	
472	47×10^2	
104	10×10^4	

③ Dielectric material.

Our company has C0G, X7R, X5R, Y5V, Z5U and other materials.

④ Size and leads shape.

Dimensions	0805	1206	1210	1808	1812	2220	2225	3838
Lmax(mm)	4.2	5.5	5.5	8.5	8.5	10.5	10.5	12.0
Wmax(mm)	3.8	4.5	5.5	6.5	6.5	8.5	9.5	12.0
Tmax(mm)	3.8	3.8	3.8	3.8	3.8	4.2	4.2	4.0

⑤ Capacity tolerance level

code	A	B	C	D.	f	G	J	K	M
tolerance	±0.05pF	±0.10pF	±0.25pF	±0.50pF	±1.0%	±2.0%	±5.0%	±10.0%	±20.0%
Remark	A, B, C, D tolerance level is generally used for ≤10pFcapacity								

⑥ Rated voltage

Voltage code	Actual value (V)	Remark
6R3	6.3	The first two digits are valid figures, and the last digit is 10 index of R as decimal point
500	50×10^{0}	
201	20×10^{1}	
102	10×10^{2}	
202	20×10^{2}	

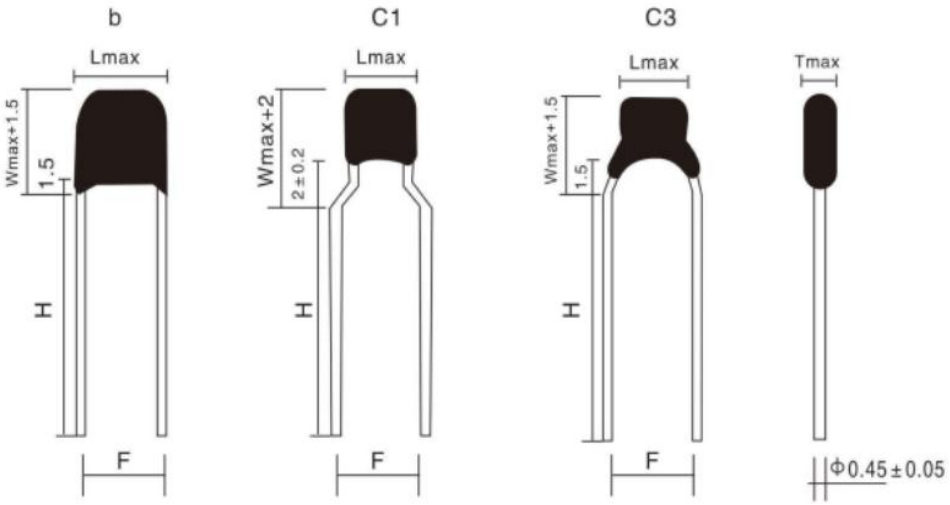
⑦ Terminal plating

Terminal plating type	Plating Code
Three-layer plating Ag(Cu)/Ni/Sn	N
Silver	S

⑧ Packaging type

Packaging type	Packaging Code
Bulk	B
Taping	T

Size and Leads shape specifications



model		Dimensions (mm)				
British system	Leads shape	f	h	L	W	Tmax
0805	b C1 C3	2.54±0.50 5.08±0.50 5.08±0.50	≥10.0 ≥5.0/10.0 ≥5.0/10.0	≤4.2	≤3.8	≤3.8
1206	b C1	3.50±0.50 5.08±0.50	≥10.0	≤5.5	≤4.5	≤3.8
1210	b C1	3.50±0.50 5.08±0.50	≥10.0	≤5.5	≤5.5	≤3.8
1808/1812	b	4.57±0.50	≥10.0	≤8.5	≤6.5	≤3.8
2220	b	5.70±0.50	≥10.0	≤10.5	≤8.5	≤4.2
2225	b	5.70±0.50	≥10.0	≤10.5	≤9.5	≤4.2
3838	b	10.3±0.50	≥10.0	≤12.0	≤12.0	≤4.0

Remarks: Products that meet customer needs can be designed according to customer's special requirements.

Conventional voltage product capacity range

Specification	0402					0603					0805					1206				
(V) / C_R	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50
100pF																				
220pF	■	■	■	■	■															
330pF	■	■	■	■	■															
470pF	■	■	■	■	■															
680pF	■	■	■	■	■															
1 nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2.2nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
4.7nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
5.6nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6.8nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
15nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
22nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
27nF	■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
33nF	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
39nF	■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
47nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
56nF	■	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
68nF	■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
100nF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
150nF	■	■	■			■	■	■	■		■	■	■	■	■	■	■	■	■	■
220nF	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
270nF						■	■	■			■	■	■	■	■					
330nF	■		■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
470nF	■		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
820nF											■	■	■			■	■	■	■	■
1.0uF	■		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2.2uF	■		■			■	■	■	■	■	■	■	■	■		■	■	■	■	■
4.7uF	■		■			■		■	■		■	■	■	■		■	■	■	■	■
6.8uF						■										■	■	■	■	
10uF						■		■	■	■		■	■	■		■	■	■	■	
22uF											■	■	■	■		■	■	■	■	
27uF																				
33uF																				
47uF											■	■				■	■	■		
100uF																■				

■ X7R ■ X5R

7. Medium and high voltage product capacity range

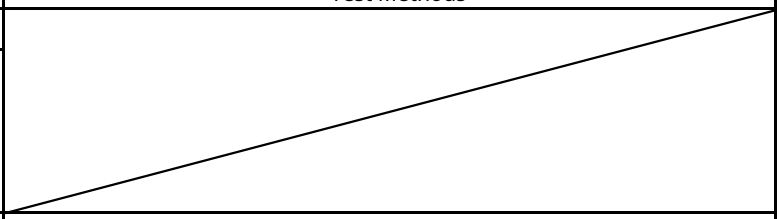
Specification	0	0805			1206					1210				
(V) / C_R	1	100	200	250	100	250	500	1000	2000	100	250	500	1000	2000
100pF			■	■	■	■	■	■	■		■	■	■	■
150pF			■	■	■	■	■	■	■		■	■	■	■
330pF			■	■	■	■	■	■	■		■	■	■	■
470pF			■	■	■	■	■	■	■		■	■	■	■
680pF			■	■	■	■	■	■	■		■	■	■	■
1000pF			■	■	■	■	■	■	■		■	■	■	■
1. 2nF	■	■	■	■	■	■	■	■	■		■	■	■	■
1. 5nF	■	■	■	■	■	■	■	■	■		■	■	■	■
2. 2nF	■	■	■	■	■	■	■	■	■		■	■	■	■
3. 3nF	■	■	■	■	■	■	■	■			■	■	■	■
4. 7nF	■	■	■	■	■	■	■	■			■	■	■	■
6. 8nF	■	■	■	■	■	■	■	■			■	■	■	■
10nF	■	■	■	■	■	■	■	■		■	■	■	■	
12nF	■	■	■	■	■	■	■			■	■	■	■	
15nF	■	■	■	■	■	■	■			■	■	■	■	
22nF	■	■	■	■	■	■	■			■	■	■		
27nF	■	■			■	■	■			■	■	■		
33nF	■	■			■	■	■			■	■	■		
39nF	■	■			■	■				■	■	■		
47nF	■	■			■	■				■	■	■		
56nF	■	■			■	■				■	■			
68nF	■	■			■	■				■	■			
100nF	■	■			■	■				■	■			
120nF		■			■					■	■			
150nF		■			■					■				
220nF		■			■					■				
270nF		■			■					■				
330nF		■			■					■				
470nF		■			■					■				
560nF					■					■				
1. 0uF					■					■				
2. 2uF										■				

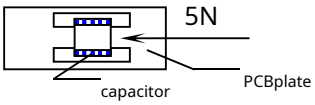
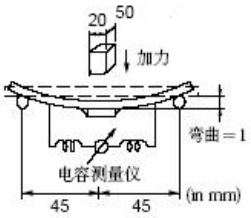
Specification	1808						1812						
(V) / C_R	100	250	500	1000	2000	3000	100	250	500	1000	2000	3000	4000
100pF	■	■	■	■	■	■		■	■	■	■	■	■
150pF	■	■	■	■	■	■		■	■	■	■	■	■
330pF	■	■	■	■	■	■		■	■	■	■	■	■
470pF	■	■	■	■	■	■		■	■	■	■	■	■
680pF	■	■	■	■	■	■		■	■	■	■	■	■
1000pF	■	■	■	■	■	■		■	■	■	■	■	■
1. 5nF	■	■	■	■	■			■	■	■	■	■	
2. 2nF	■	■	■	■				■	■	■	■	■	
2. 7nF	■	■	■	■				■	■	■	■	■	
3. 3nF	■	■	■	■				■	■	■	■	■	
4. 7nF	■	■	■	■				■	■	■	■	■	
6. 8nF	■	■	■	■				■	■	■	■		
10nF	■	■	■	■			■	■	■	■	■		
12nF	■	■	■	■			■	■	■	■			
15nF	■	■	■	■			■	■	■	■			
22nF	■	■	■				■	■	■	■			
27nF	■	■	■				■	■	■	■			
33nF	■	■	■				■	■	■	■			
39nF	■	■	■				■	■	■	■			
47nF	■	■	■				■	■	■	■			
56nF	■	■	■				■	■	■				
68nF	■	■					■	■	■				
100nF	■	■					■	■	■				
120nF	■	■					■	■	■				
150nF	■	■					■	■	■				
220nF	■						■	■					
270nF							■						
330nF							■						
470nF							■						
2. 2uF							■						

Specification	2225						
(V) / CR	100	250	500	1000	2000	3000	4000
100pF		■	■	■	■	■	■
150pF		■	■	■	■	■	■
180pF		■	■	■	■	■	■
220pF		■	■	■	■	■	■
330pF		■	■	■	■	■	■
470pF		■	■	■	■	■	■
680pF		■	■	■	■	■	■
1000pF		■	■	■	■	■	■
1. 5nF		■	■	■	■	■	■
2. 2nF		■	■	■	■	■	■
3. 3nF		■	■	■	■	■	■
4. 7nF		■	■	■	■	■	
6. 8nF		■	■	■	■	■	
10nF	■	■	■	■	■	■	
12nF	■	■	■	■	■	■	
15nF	■	■	■	■	■		
22nF	■	■	■	■	■		
27nF	■	■	■	■	■		
33nF	■	■	■	■	■		
39nF	■	■	■	■			
47nF	■	■	■	■			
56nF	■	■	■	■			
68nF	■	■	■	■			
100nF	■	■	■	■			
120nF	■	■	■				
150nF	■	■	■				
220nF	■	■	■				
270nF	■	■	■				
330nF	■	■	■				
470nF	■	■	■				
820nF	■	■					
1uF	■						
2. 2uF							

Note: When customers have special requirements, please specify when ordering.

Product Specifications

<table>
<tr><td>project</td><td colspan="2">technical specifications</td><td colspan="5">Test Methods</td></tr>
<tr><td rowspan="2">range of working temperature</td><td>Class I</td><td>C0G: -55 ~ +125℃</td><td colspan="5" rowspan="2">  </td></tr>
<tr><td>Class II</td><td>X7R: -55 ~ +125℃
X5R: -55 ~ +85℃
Y5V: -30 ~ +85℃
Z5U: +10 ~ +85℃</td></tr>
<tr><td>Exterior</td><td colspan="2">no obvious defects</td><td colspan="5">Visual inspection</td></tr>
<tr><td rowspan="5">Capacitance</td><td rowspan="2">Class I</td><td rowspan="2">within specification error</td><td>Nominal capacity</td><td>test frequency</td><td>Test voltage</td><td colspan="2">ambient temperature</td></tr>
<tr><td>≤1000pF</td><td>1MHz±10%</td><td rowspan="2">1.0±0.2Vrms</td><td colspan="2" rowspan="4">25±2℃</td></tr>
<tr><td>>1000pF</td><td>1KHz±10%</td></tr>
<tr><td rowspan="3">Class II</td><td rowspan="3">within specification error</td><td>≤10μF</td><td>1KHz±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td>>10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr>
<tr><td>Z5U</td><td>1.0±0.1KHz</td><td>0.5±0.05Vrms</td></tr>
<tr><td rowspan="2">loss tangent (DF)
Dissipation Factor</td><td>Class I</td><td colspan="6">Cap≤50pF,DF≤1.5×(150/CR+7)×10-4;Cap≥50pF,DF≤0.15%</td><td rowspan="2">High volume products 5 suffix DF≤7.5%
6 suffix DF≤10.0%
The rest 0603 And capacitor products below 0603 DF≤ 10.0%</td></tr>
<tr><td>Class II</td><td colspan="6"><table><tr><td>额定电压</td><td>≥100V</td><td>50V</td><td>25V</td><td>16V</td><td>10V</td><td>6.3V</td></tr><tr><td>X7R</td><td rowspan="2">≤2.5%</td><td>≤3.5%</td><td>(C≤1μF)</td><td>≤5.0%(C≤1μF)</td><td>≤5.0%(C≤3.3μF)</td><td>≤7.5%(C<3.3μF)</td></tr><tr><td>X5R</td><td>≤5.0%</td><td>(C>1μF)</td><td>≤7.5%(C>1μF)</td><td>≤10.0%(C>3.3μF)</td><td>≤10.0%(C≥3.3μF)</td></tr><tr><td rowspan="2">Y5V
Z5U</td><td colspan="2">≥25V</td><td colspan="4">25V>UR≥6.3V</td></tr><tr><td colspan="2">≤7.0%(C≤1μF)</td><td colspan="4" rowspan="2">≤12.5%</td></tr><tr><td colspan="2">≤9.0%(C≥1μF)</td></tr></table></td></tr>
<tr><td rowspan="3">Insulation resistance (IR)
Insulation Resistance</td><td>Class I</td><td colspan="2">C≤10nF,Ri≥10000MΩ C>10nF,R*CR≥100S</td><td>额定电压</td><td>测试电压</td><td>测试时间</td><td>充放电电流</td><td>环境</td></tr>
<tr><td rowspan="2">Class II</td><td>X7R
X5R</td><td>C≤25nF,Ri≥4000MΩ C>25nF,R*CR>100S</td><td>Ur＜500V</td><td>Ur</td><td>60±5sec</td><td>⩽50mA</td><td rowspan="2">温度25±2℃
湿度<75%</td></tr>
<tr><td>Y5V
Z5U</td><td>C≤25nF,Ri≥4000MΩ C>25nF,R*CR>100S</td><td>Ur⩾500V</td><td>500V</td><td>60±5sec</td><td>⩽50mA</td></tr>
<tr><td>Dielectric strength (DWV)
Dielectric Withstanding Voltage</td><td colspan="2">There should be no dielectric breakdown or damage</td><td>Rated voltage</td><td>Test voltage</td><td>time</td><td colspan="2">Charge and discharge current</td></tr>
<tr><td colspan="3" rowspan="3"></td><td>Ur<200V</td><td>2.5Ur</td><td>1~5sec</td><td colspan="2" rowspan="3">≤50mA</td></tr>
<tr><td>200V≤Ur≤1000V</td><td>1.5Ur</td><td>1~5sec</td></tr>
<tr><td>Ur>1000V</td><td>1.2Ur</td><td>1~5sec</td></tr>
<tr><td rowspan="6">capacity temperature coefficient or temperature characteristics</td><td rowspan="2">Class I</td><td rowspan="2">C0G: 0±30ppm/℃</td><td colspan="5" rowspan="2">preprocessing (IIkind):150+0/-10℃,1hrs,placetwenty four±2hrsAfter the initial measurement in the following temperature sequence, the temperature stabilized30minpost-determination (△CbyT3prevail)</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="4">Class II</td><td rowspan="4">X7R:≤±15%
X5R:≤±15%
Y5V: +22%~-82%
Z5U: +22%~-56%</td><td>step</td><td colspan="4">temperature (°C)</td></tr>
<tr><td>T1</td><td colspan="4">20±2</td></tr>
<tr><td>T2</td><td colspan="4">lower class temperature (eg X7R -55±3)</td></tr>
<tr><td>T3</td><td colspan="4">20±2</td></tr>
<tr><td>T4</td><td colspan="4">upper class temperature (eg X7R +125±2)</td></tr>
<tr><td>T1</td><td colspan="4">20±2</td></tr>
<tr><td>Solderability</td><td>Exterior</td><td>No visible damage, tin rate ≥ 95%</td><td colspan="5">Soak the capacitor in the solution of ethanol and rosin (accounting for 25% by weight), take it out and preheat it at a temperature of 80-120°C for 10-30 seconds, and then immerse it in the solder solution.
Dipping temperature: 235±5°C; Dipping speed: 25±0.25mm/s
Dipping time: 2±0.5sec</td></tr>
</table>

Resistance to soldering heat	Exterior	No visible damage, tin rate ≥ 95%	Soak the capacitor in a solution of ethanol and rosin (accounting for 25% by weight), take it out and preheat it at a temperature of 100-200°C for 10±2min, and then immerse it in the solder solution. Immersion tin temperature:260±5℃; Immersion tin speed:25±0.25mm/s Dipping time:5±1sec After taking it out, clean it with solvent, and then10observed under a microscope at a magnification of magnification. After the test, place it indoors for 24±2hrs before measuring.
	△C/C	Iclass: ≤±0.5%or±0.5pF, whichever is greater	
		IIClass: X7R, X5R : -5~+10% Y5V ,Z5U: -10~+20%	
	DF	same as original standard	
	IR	same as original standard	
terminal electrode Adhesion strength	The terminal electrodes are not peeled off, and the appearance has no visible damage		Apply thrust:5N time:10±1sec speed:1mm/sec 
Bending strength	Exterior	no visible damage	Test substrate:PCB Bending Depth:1mm Pressure speed: 1±0.5mm/sec. Measurements should be made in the bent state. 
	△C/C	Iclass: ≤±5%	
		IIclass: ≤±10%	
temperature cycle	Exterior	no visible damage	preprocessing (IIkind):150+0/-10°C,1hrs,placetwenty four±2hrsafter initial measurement Cycles:5times, a cycle is divided into the following4step:
	△C/C	Iclass: ≤±1%or±1pF whichever is greater	
		IIClass:X7R X5R≤±10% Z5U Y5V≤±20%	
	DF	same as original standard	
	IR	same as original standard	Placed indoors after the test24±2hrsMeasure again.

stage	temperature °C	time (minutes)
No.1step	Lower category temperature	30
No.2step	20±2	3
No.3step	upper category temperature	30
No.4step	20±2	3

Steady State Humidity Test	Exterior	no visible damage	temperature:40±2℃ humidity:90~95%RH time:500+24/-0Hour Storage conditions: room temperature Placement time:twenty fourHour(Ikind);48Hour(IIkind)
	△C/C	IClass: ≤±2% or ±1pF whichever is greater	
		IIClass: X7R X5R≤±10% Z5U Y5V≤±30%	
	DF	≤2times initial standard	
	IR	IClass:Ri≥2500MΩorR*C_R>25S take the lesser of the two	
		IIClass:Ri≥1000MΩorR*C_R>25S take the lesser of the two	
life test	Exterior	no visible damage	
	△C/C	IClass: ≤±2% or ±1pF whichever is greater	
		IIClass:X7R X5R≤±20% Z5U Y5V≤±30%	
	DF	≤2times initial standard	Charge and discharge current: ≤50mA Temperature: upper class temperature Time: 96±4 hours Storage conditions: room temperature Placement time:twenty fourHour(Ikind);48Hour(IIkind)
	IR	IClass:Ri≥4000MΩorR*C_R>40S take the lesser of the two	
		IIClass:Ri≥2000MΩorR*C_R>50S take the lesser of the two	

Rated voltage	Applied voltage
Ur<500V	2UR
500V≤Ur≤1000V	1.5Ur
Ur>1000V	1.2Ur

* Notes:

1. Pretreatment (only for class II capacitors):

After the capacitor has been exposed to the upper category temperature or a higher temperature as may be specified in the detail specification for 1 h, it is then recovered for 24 ± 1 h under the standard atmospheric conditions of the test.

2. When testing the dielectric strength of the capacitor, in order to exclude the influence of the external environment, when the test voltage exceeds 2000Vdc, the capacitor should be soaked in insulating oil for testing.

Precautions for use

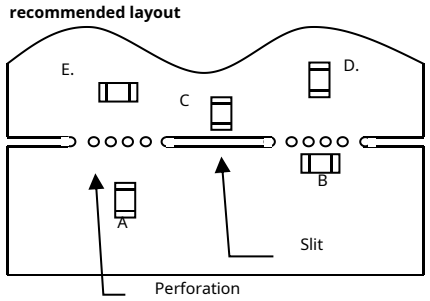
1. Precautions before use:

The MLCC/MLCV chip may be damaged under the harsh working environment or external mechanical overpressure that exceeds the operating conditions described in the relevant instructions of this acknowledgment.

2. PC board design

2.1 The amount of solder used will affect the ability of the chip to resist mechanical stress, which may cause MLCC/MLCV to break or crack. Therefore, when designing the substrate, the size and configuration of the pad must be carefully considered, which have a decisive effect on the amount of solder that makes up the substrate.

2.2 When designing the position of the pad and SMD MLCC/MLCV, the stress should be minimized, and the MLCC/MLCV should be installed on the least affected position on the PC board.



4.5

Stress value: A>B=C>D>E

3. Issues that should be considered in automatic installation

If the pick-up tube is lowered beyond the minimum limit, it will cause excessive pressure on the MLCC/MLCV, which will cause the MLCC/MLCV to rupture. When lowering the pick-up tube, note the following points:

3.1 After correcting the deviation of the PC board, the low limit of the pick-up tube should be adjusted to the surface level of the PC board.

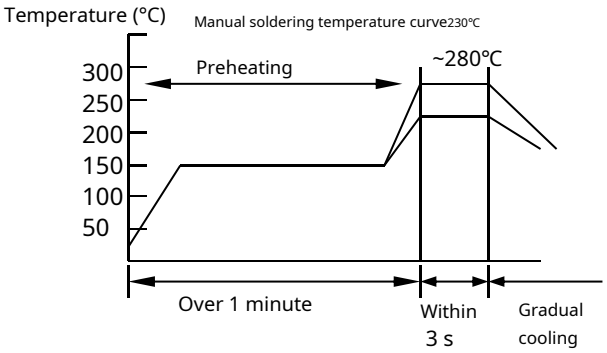
3.2 The suction pressure should be adjusted to between 1 and 3N.

3.3 In order to reduce the deformation of the PC board caused by the impact force of the pick-up tube, the supporting nails should be placed under the PC board.

4. Welding

4.l MLCC/MLCV is a combination of ceramic and metal. As ceramic bodies, especially large-scale ceramic bodies, The thermoplastic itself is poor, and the response to heat is relatively slow. Under the condition of rapid cooling and rapid heating, the ceramic body is easy to crack.

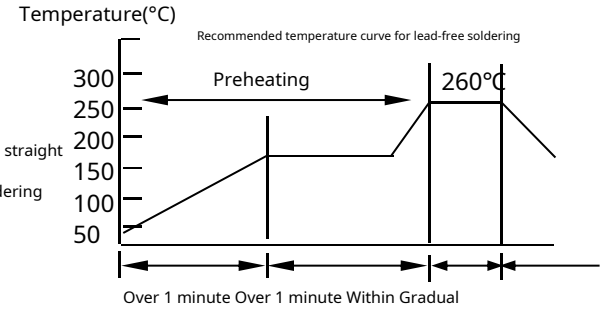
It is recommended to perform continuous preheating for more than 1 minute before welding.



4.2 The interior of MLCC/MLCV is a metal electrode, which has good thermoplasticity and responds quickly to heat. Thus, in In the case of heat, the metal part and the ceramic part must exist Inconsistencies in expansion to a certain extent, resulting in internal

Internal stress can easily cause the porcelain body to crack. It is recommended that before soldering

Perform continuous preheating over 1 minute.



4.3 When manual soldering, use a constant temperature soldering iron with a pointed straight

The maximum diameter is 1.0mm, and the maximum power is 25 watts; the soldering

iron cannot touch the MLCC/MLCV components directly.

4.4 It is recommended to avoid wave soldering for specifications above 1206.

5. Cleaning

5.1 The temperature difference between the components and the cleaning process should not exceed 100°C.

5.2 In the case of ultrasonic cleaning, if the output power is too large, the PC board will be subjected to excessive vibration, which will cause MLCC/MLCV or Solder joints are cracked, or terminal electrode strength is reduced. Therefore, pay special attention to the following points: Ultrasonic output: less than 20W/L; ultrasonic frequency: less than 40KHz; ultrasonic cleaning time: 5 minutes or less

6. Cutting the PC board

6.1 After installing MLCC/MLCV and other components, when splitting the PC board, be careful not to exert any force on the board. Do not subject MLCC/MLCV to excessive mechanical shock.

6.2 Segmentation of boards shall not be performed by hand, but with appropriate equipment.

7. Storage method

In order to maintain the solderability of the terminal electrodes and ensure that the packaging materials are in good condition, the recommended storage conditions are as follows: Storage temperature: 5-40°C; Storage relative humidity: 20-70%RH

Even if stored under ideal storage conditions, the solderability of MLCC/MLCV terminals will decrease over time, so MLCC/MLCV should be used within 6 months from the date of shipment.