

General Capacitors

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

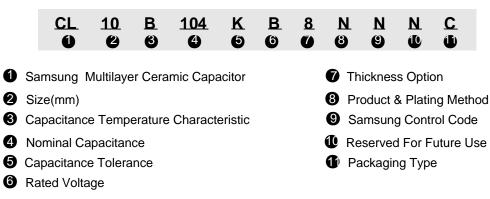
General Features

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

Applications

- General Electronic Circuit

Part Numbering



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



Code	Temperature Characteristics				Temperature Range
С		COG	C	0 ± 30 (ppm/ $^{\circ}\mathrm{C}$)	
Р		P2H	PA	-150 ± 60	
R	-	R2H	RA	-220±60	
S	Class	S2H	SA	-330±60	-55 ~ +125℃
т		T2H	TΔ	-470±60	
U		U2J	UA	-750±60	
L	_	S2L	SA	+350 ~ -1000	
Α		X5R	X5R	±15%	-55 ~ +85℃
В	Class II	X7R	X7R	±15%	-55 ~ +125℃
X		X6S	X6S	±22%	-55 ~ +105℃
F		Y5V	Y5V	+22 ~ -82%	-30 ~ +85℃

O CAPACITANCE TEMPERATURE CHARACTERISTIC

***** Temperature Characteristic

Temperature Characteristics	Below 2.0pF	2.2 ~ 3.9pF	Above 4.0pF	Above 10pF
C∆	C0G	C0G	C0G	C0G
PΔ	-	P2J	P2H	P2H
R∆	-	R2J	R2H	R2H
S∆	-	S2J	S2H	S2H
ТΔ	-	T2J	T2H	T2H
UΔ	-	U2J	U2J	U2J

 $J: \pm 120$ PPM/°C, $H: \pm 60$ PPM/°C, $G: \pm 30$ PPM/°C

O 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 µ F	
104	100,000pF, 100nF, 0.1 µ F	



G CAPACITANCE TOLERANCE

Code	Tolerance	Nominal Capacitance
А	\pm 0.05pF	
В	±0.1pF	
С	\pm 0.25pF	Less than 10pF (Including 10pF)
D	± 0.5pF	
F	±1pF	
F	±1%	
G	±2%	
J	±5%	
к	±10%	More than 10pF
м	±20%	
Z	+80, -20%	

6 RATED VOLTAGE

Code	Rated Voltage	Code	Rated Voltage
R	4.0V	D	200V
Q	6.3V	E	250V
Р	10V	G	500V
0	16V	н	630V
Α	25V	I	1,000V
L	35V	J	2,000V
В	50V	к	3,000V
С	100V		



7 THICKNESS OPTION

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

General Capacitors

③ PRODUCT & PLATING METHOD

Code	Electrode	Termination	Plating Type
Α	Pd	Ag	Sn_100%
N	Ni	Cu	Sn_100%
G	Cu	Cu	Sn_100%

③ SAMSUNG CONTROL CODE

Code	Description of the code	Code	Description of the code
Α	Array (2-element)	N	Normal
В	Array (4-element)	Р	Automotive
С	High - Q	L	LICC



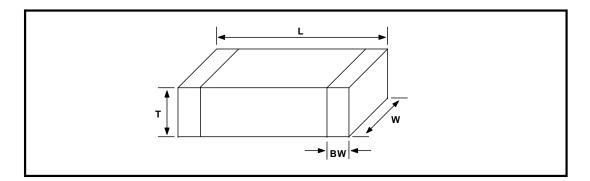
① RESERVED FOR FUTURE USE

Code	Description of the code	
N	Reserved for future use	

^① PACKAGING TYPE

Code	Packaging Type	Code	Packaging Type
В	Bulk	F	Embossing 13" (10,000EA)
Р	Bulk Case	L	Paper 13" (15,000EA)
С	Paper 7"	0	Paper 10"
D	Paper 13" (10,000EA)	S	Embossing 10"
E	Embossing 7"		

APPEARANCE AND DIMENSION



CODE	EIA CODE	DIMENSION (mm)				
CODE		L	W	T (MAX)	BW	
03	0201	0.6 ± 0.03	$0.3~\pm~0.03$	0.33	0.15 ± 0.05	
05	0402	1.0 ± 0.05	$0.5~\pm~0.05$	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	$2.0~\pm~0.1$	1.25 ± 0.1	1.35	0.5 +0.2/-0.3	
24	1000	3.2 ± 0.15	1.6 ± 0.15	1.40	0.5 +0.2/-0.3	
31	1206	3.2 ± 0.2	1.6 ± 0.2	1.8	0.5 +0.3/-0.3	
22	1210	3.2 ± 0.3	2.5 ± 0.2	2.7	0.6 ± 0.3	
32	1210	3.2 ± 0.4	$2.5~\pm~0.3$	2.8	0.6 ± 0.3	
43	1812	$4.5~\pm~0.4$	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	



NO	ITE	м	PER	FORMANCE	TEST	CONDITION		
1	Appea	rance	No Abnormal Exterior	Appearance	Through Microscope(×10)		
2	Insula Resist		10,0001 or 5001 or 10,0001 or 1001 or 10000 or 100000 or 10000 or 100000 or 10000 or 10000 or 10000 or	w 16V ;	Apply the Rated Voltage	For 60 ~ 120	Sec.	
3	Withsta Volta	0	No Dielectric Breakdo Mechanical Breakdowi		ClassI: 300% of the Rate ClassI: 250% of the Rate with less than 50mA curren	d Voltage for 1~5		
	Class				Capacitance	Frequency	Voltage	
		Class	Within the specifie	ed tolerance	≤ 1,000 pF	1 [∭] z ±1 0%		
	L Capacita				>1,000 pF	1 kHz ±1 0%	0.5 ~ 5 Vrms	
4	nce				Capacitance	Frequency	Voltage	
		Class	Within the specif	ied tolerance	$\leq 10 \mu F$	1 kHz ±1 0%	1.0±0.2Vrms	
		Π			>10 <i>µ</i> F	120Hz±20%	0.5±0.1Vrms	
			Capacitance ≥ 30pF	: Q ≥ 1.000	Capacitance	Frequency	Voltage	
5	Q	Class		: Q ≥ 400 +20C	≤ 1,000 pF	1 ^{Mb} ±10%		
		Ι	((: Capacitance)	>1,000 p ^F	1 kHz ±1 0%	0.5 ~ 5 Vrms	
			1. Characteristic : A(X5R), B(X7R), X(X6S)	Capacitance	Frequency	Voltage	
			Rated Voltage	Spec	≤ 10 <i>µ</i> F	1 kHz ±1 0%	1.0±0.2Vrms	
			≥ 25V 0.025 max >10/d ²	>10 <i>µ</i> F	120 ^{Hz} ±20%	0.5±0.1Vrms		
			16V	0.035 max				
			10V	0.05 max	1			
			6.3V	0.05 max/ 0.10max*1	*1. 0201 C≥0.022uF, 0	402 C≥0.22uF,	0603 C≥2.2uF,	
			2. Characteristic : F(Y5V)	1812 C≥47uF, 2220 All Low Profile Capa	0805 C≥4.7uF, 1206 C≥10uF, 1210 C≥22u 1812 C≥47uF, 2220 C≥100uF, All Low Profile Capacitors (P.16).		
6	Tan∂	Class	Rated Voltage	Spec	*2 0603 C≥0.47uF, 08 *3. 0402 C≥0.033uF, 00			
		П	50V	0.05 max, 0.07max* ²	All 0805, 1206 size		F	
			35V	0.07 max	*4 1210 C>6.8uF	, 1210 0 = 0.04		
			25V	0.05 max/ 0.07 max* ³ / 0.09max* ⁴	*5 0402 C≥0.22uF *6 All 1812 size			
			16V	0.09 max/ 0.125max*⁵				
			10V	0.125 max/ 0.16max*6				
			6.3V	0.16max				



NO	ITE	M		PERFOR	MANCE		TEST CONDITION		
						Capacitance s	shall be measured by the steps		
					T 0 "		following table.		
			Character	ristics	Temp. Coefficient (PPM℃)	Step	Temp.(°C)		
			COG		0 ± 30		25 ± 2		
			PH	,	-150 ± 60				
		Class	RH		-220 ± 60	2	Min. operating temp. \pm 2		
		I	SH		-330 ± 60	3	25 ± 2		
			тн		-470 ± 60	4	Max. operating temp \pm 2		
			UL		-470 ± 80 -750 ± 120	5	25 ± 2		
			SL			(1) Class I			
			<u>3L</u>		+350 ~ -1000	Temperature	Coefficient shall be calculated from		
	Temperature					the formula as	s below.		
7	Characteristics of Capacitance					Temp, Coefficier	$nt = \frac{C2 - C1}{C1 \times \bigtriangleup T} \times 10^6 \; [ppm/^{\circC}]$		
						C1; Capacita	ance at step 3		
						C2: Capacita			
			Characte	ristics	Capacitance Change with No Bias	దT: 60°C(=8			
		Class	A(X5F B(X7	R)/ R)	± 15%	(2) CLASS II			
		Π	X(X6	S)	±22%	Capacitance (Change shall be calculated from the		
					+22% ~ -82%	formula as be	-		
			F(Y5)	v)	+22 /0 ~ -02 /0	C2 -	C1 v 100(9/)		
						C1	<u>C1</u> × 100(%)		
						C1; Capacita	ance at step 3		
						C2: Capacita	ance at step 2 or 4		
						Apply 500g.f	* Pressure for 10 \pm 1 sec.		
						* 200g.f for 0201 case size.			
8	Adhesive of Termi	-	No Indication Of Peelir Terminal Electrode.		ing Shall Occur On The				
	or renn	nation		centrue.			500g.f		
						Bending limit	; 1mm		
		Apperance	No mecha	nical dam	age shall occur.	Test speed ;			
							board at the limit point in 5 sec.,		
			Characte	eristics	Capacitance Change	Then measure			
					Within \pm 5% or \pm 0.		-		
			Class						
			Clas	SI			20 ∠ ► <u>R=230</u>		
	Bending				larger	50			
9	Strength			A(X5R)/					
		Capacitance		B(X7R)/	Within \pm 12.5%				
				X(X6S)			<u> </u>		
							Bending limit		
			Class II			['] 45±1	45±1		
				F(Y5V)	Within \pm 30%				



$10 \text{Solder ability} \qquad \qquad$	NO	п	EM		PERF	DRMANCE		TEST COND	ITION		
$10 \qquad 10 \qquad$				More Thar	n 75% of th	e terminal surface is to	Solder	Sn-3Ag-0.5C	4 63Sn-37Pb		
10 Solderability Apperance No mechanical damage shall occur. Flux RMA Type 11 Apperance No mechanical damage shall occur. Solder Temperature : 270±5°C Dp Tme : 10±10 sec. 11 Resistance to Soldering heat Capacitance Change Within ±2.5% of class I Solder Temperature : 270±5°C 11 Resistance to Soldering heat Capacitance 2: 20±10 Solder Temperature : 270±5°C 11 Resistance to Soldering heat Capacitance 2: 20±100 Solder Temperature : 270±5°C 11 Resistance to Soldering heat Capacitance 2: 20±1000 Solder Temperature : 270±5°C 11 Resistance Capacitance 2: 20±1000 Solder Temperature : 270±5°C 12 Vibration Q (Class II) Capacitance 2: 20±1000 Solder Temperature : 270±5°C 12 No mechanical damage shall occur. Solder Temperature : 270±5°C Dip Time : 10±10 13 Q (Class II) Capacitance 2: 20±1000 Solder Temperature : 270±5°C 14 Resistance Q (Class II) Within the specified initial value Leave the capacitor in ambient condition for specified time' before measurement ': 24 ± 2 hours (Class II) 12 Yubration Appearance No mechanical damage shall occur. Tem capacitor shall be subjected to a faramonic Motion having a total amplitude of 1.5mm changing frequency from 1	10					o metal part does not	Solder	045.5%			
Image: Image: <td></td> <td></td> <td></td> <td>come out</td> <td>or dissolve</td> <td></td> <td>Temp.</td> <td>245±5 C</td> <td>235±5 C</td>				come out	or dissolve		Temp.	245±5 C	235±5 C		
11 Apperance No mechanical damage shall occur. Solder Terperature : 270.5°C 11 Resistance to Soldering heat Capacitance Characteristics Capacitance Change class II Solder Terperature : 270.5°C 11 Resistance to Soldering heat Capacitance Class II Class II Solder Terperature : 270.5°C 11 Resistance to Soldering heat Capacitance Class II Class II Solder Terperature : 270.5°C 11 Resistance to Soldering heat Capacitance Class II Vithin ±2.5% or ±0.25/F whichever is larger Solder Terperature : 270.5°C 11 Resistance to Class II Capacitance Capacitance Solder Terperature : 270.5°C 12 Mithin terperature : 270.5°C Dip Time : 1024 sec. Each termination shall be fully immersed and preheated as below : 11 Q (Class II) Capacitance Capacitance Solder Terperature : 270.5°C 12 Mithin terperature : 270.5°C Time : 1000 (Class II) Solder : 1000 (Class II) Solder : 1000 (Class II) 13 Appearance Within the specified initial value Solder: initial value Solder: 1000 (Class II) Solder: 1000 (Class II) The capacitor shall be subjected to a Harmonic Motion hav	10	Solde	erability		\square		Flux	RM	А Туре		
11 Apperance No mechanical damage shall occur. Solder Temperature : 270±5°C 11 Resistance to Soldering heat Capacitance Characteristics Capacitance Change au30±5°C whithever is larger Solder Temperature : 270±5°C 11 Resistance to Soldering heat Capacitance Capacitance Solder Temperature : 270±5°C 11 Resistance to Soldering heat Capacitance Capacitance Solder Temperature : 270±5°C 12 Resistance to Soldering heat Capacitance Capacitance Capacitance Solder Temperature : 270±5°C 12 Resistance to Soldering heat Q (Class I) Capacitance Capacitance Solder Temperature : 270±5°C 12 Vbration Tan ô (Class II) Within the specified initial value Solder Temperature : 270±5°C Dip Time : 10±1 sec. 12 Vbration Test Q (Class II) Capacitance = 300F : 0 2 = 1000 (Class II) Capacitance = 30F Capacitance 12 Vbration Test Q (Class II) Within the specified initial value No mechanical damage shall occur. 12 Vbration Test Capacitance (Class II) 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. 12 Q (Class II) Within the specified initial				│ ──▶ / / / //◀───			Dip Time	3±0.3 sec.	5±0.5 sec.		
$11 \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$					1		Pre-heating	at 80~120℃	for 10~30 sec.		
$11 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $			Apperance	No mecha	anical dam	age shall occur.	Solder Tem	berature : 270±	5°C		
$11 \ \ \ \ \ \ \ \ \ \ \ \ \$				Charac	teristics	Capacitance Change	Dip Time :	10±1 sec.			
$11 \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$						Within ±2.5% or	Each termin	ation shall be f	ully immersed and		
$11 \begin{tabular}{ c c c c c } \hline 1 & \hline $				Clas	s I	$\pm 0.25\mathrm{pF}$ whichever is	preheated a	s below :			
$11 \begin{array}{ c c c c } \hline \begin{tabular}{ c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$			Capacitance			larger					
11Resistance to Soldering heat $Class II$ $B(X7R)$ I I O O 11Soldering heat Q (Class I) $Capacitance \ge 30\mu^2 : Q \ge 1000\le 30\mu^2 : Q \ge 1000(C: Capacitance)Capacitance \ge 30\mu^2 : Q \ge 1000\le 30\mu^2 : Q \ge 1000(C: Capacitance)24 \pm 2 hours (Class I)24 \pm 2 hours (Class I)11InsulationResistanceWithin the specified initial value24 \pm 2 hours (Class II)24 \pm 2 hours (Class II)12VibrationTestAppearanceNo mechanical damage shall occur.12VibrationTestCapacitanceCharacteristicsCapacitanceCapacitance ChangeVithin the specified initial value12VibrationTestCapacitanceO(Class I)Vithin the specified initial value12VibrationTestQ(Class I)Vithin the specified initial value13VibrationTestQ(Class II)Vithin the specified initial value14VibrationTestQ(Class II)Vithin the specified initial value15Q(Class II)Vithin the specified initial value16Q(Class II)Vithin the specified initial value17Q(Class II)Vithin the specified initial value18Q(Class II)Vithin the specified initial value19Q(Class II)Vithin the specified initial value10Insulation(Class II)Vithin the specified initial value11InsulationInsulationVith$			Capacitance		A(X5R)/	Within +7.5%					
$11 \begin{array}{ c c c c } \hline & X(XS) & Within \pm 15\% \\ \hline & X(XS) & Within \pm 15\% \\ \hline & Within \pm 15\% \\ \hline & Within \pm 20\% \\ \hline & & & & & & & \\ \hline & & & & & & & \\ \hline & & & &$				Class II	B(X7R)	Within 17.576					
11 Notice Q Capacitance $\geq 30 \text{ pl}^{-1} : Q \geq 1000$ Specified time before measurement specified time before measurement 11 Soldering heat Q Capacitance $\geq 30 \text{ pl}^{-1} : Q \geq 400 + 20xC$ specified time before measurement specified time before measurement 11 Tan δ (Class I) Within the specified initial value specified time before measurement *24 ± 2 hours (Class I) 24 ± 2 hours (Class I) 11 Insulation Resistance Within the specified initial value *24 ± 2 hours (Class I) *24 ± 2 hours (Class I) 12 Vibration Resistance Within the specified initial value *24 ± 2 hours (Class II) 12 Vibration Appearance No mechanical damage shall occur. Appearance 12 Vibration Test Capacitance Class I Within ±2.5% or ±0.25 pl ² whichever is larger 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. 12 Vibration Q (Class I) X(X6S) Within ±20% 14 Tan δ (Class II) Within the specified initial value Perpendicular directions 15 Tan δ <td></td> <td></td> <td></td> <td></td> <td>X(X6S)</td> <td>Within ±15%</td> <td>2</td> <td>150~180</td> <td>60</td>					X(X6S)	Within ±15%	2	150~180	60		
Soldering heat Q (Class I) Capacitance $\geq 30 \mu^{c}$: $Q \geq 1000$ $< 30 \mu^{c}$: $Q \geq 400 + 20 xC$ (C: Capacitance) specified time* before measurement * 24 ± 2 hours (Class I) Tan δ (Class II) Within the specified initial value * 24 ± 2 hours (Class I) Insulation Resistance Within the specified initial value * 24 ± 2 hours (Class II) Within the specified initial value Within the specified initial value * 24 ± 2 hours (Class II) Vibration Resistance Within the specified initial value * 24 ± 2 hours (Class II) Vibration Rapearance No mechanical damage shall occur. * 40.25 µ ^c whichever is larger * 1e 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. 12 Vibration Test Q (Class I) No within the specified initial value * RX5RY KX6S Within ±10% F(Y5V) * Repeat this for 2hours each in 3 mutually perpendicular directions	11	Resistance to			F	Within ±20%	Leave the c	apacitor in amb	ient condition for		
$12 Vibration \\ Test \\ 12 Vibration \\ Test \\ Vibration \\ Vibin the specified initial value \\ Vibration \\ Test \\ Vibration \\ Test \\ Vibration \\ Vibin the specified initial value \\ Vibration \\ Test \\ Vibration \\ Vibin the specified initial value \\ Vibration \\ Test \\ Vibration \\ Vibin the specified initial value \\ Vibin the specified ini$		Soldering heat	0	Capacitar	ice \geq 30 pF	: Q \geq 1000					
$12 Vibration \\ Test \\ 12 Vibration \\ Vithin the specified initial value \\ 12 Vibration \\ Test \\ 12 Vibration \\ 13 Vibration \\ 13 Vibration \\ 14 Vibration \\ 16 Vibration \\ 16 $					<30 pF	: Q≥ 400+20×C					
$12 Vibration \\ Test Vibration \\ Test Q \\ Q \\ (Class II) Within the specified initial value \\ \hline (Class II) With$			(,			(C: Capacitance)	24 ± 2 ho	ours (Class Ⅱ)			
$12 Vibration \\ Test \\ Vibration \\ Vibration \\ Test \\ Vibration \\ Vibration \\ Test \\ Vibration \\ Vibration \\ Vibration \\ Vibration \\ Vibration \\ Test \\ Vibration \\ Vibration$			Tan δ	Within the	specified	initial value					
12 Vibration Within the specified initial value 12 Vibration Mithin the specified initial value 12 Vibration Appearance No mechanical damage shall occur. 12 Vibration Characteristics Capacitance Change 12 Vibration Capacitance Ciass I Within ±2.5% or ±0.25 pl ^c whichever is larger 12 Vibration Capacitance Appearance No mechanical damage shall occur. 12 Vibration Capacitance Mithin ±2.5% or ±0.25 pl ^c whichever is larger 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 ln 1 min. B(X7R) B(X7R) Within ±5% Repeat this for 2hours each in 3 mutually perpendicular directions Prevention Q Within the specified initial value Prevention Insulation Within the specified initial value Mithin the specified initial value			(Class Ⅱ)								
12 Vibration Test Q (Class I) 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. 12 Vibration Test Q (Class I) A(X5R)' B(X7R) Within ±2.5% or ±0.25 pi ⁻ whichever is larger 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. 12 Vibration Test Q (Class I) Within the specified initial value 12 Within the specified initial value Mithin the specified initial value 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. 13 Q (Class I) Within the specified initial value Perpendicular directions 14 Tan δ (Class II) Within the specified initial value Perpendicular directions				Within the	e specified	initial value					
12 Vibration Test Q (Class I) 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. 12 Vibration Test Q (Class I) A(X5R)' B(X7R) Within ±2.5% or ±0.25 pi ⁻ whichever is larger 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. 12 Vibration Test Q (Class I) Within the specified initial value 12 Within the specified initial value Mithin the specified initial value 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. 13 Q (Class I) Within the specified initial value Perpendicular directions 14 Tan δ (Class II) Within the specified initial value Perpendicular directions			Withstanding								
$12 Vibration \\ Test Q \\ (Class I) \\ \hline Mithin the specified initial value \\ \hline Class I \\ II \\ \hline Mithin the specified initial value $			Voltage	Within the	e specified	initial value					
$12 Vibration \\ Test \qquad Q \\ (Class I) \qquad Q \\ (Class I) \qquad Vibrin the specified initial value \qquad Vibration \\ Test \qquad Vibration \\ Vithin the specified initial value \\ \\ V$			Appearance	No mecha	anical dam	age shall occur.					
$12 Vibration \\ Test Q \\ (Class I) Vithin \pm 2.5\% \text{ of } \pm 0.25 \text{ pF whichever is } \\ larger \\ II X(X6S) \\ Vithin \pm 5\% \\ II X(X6S) \\ Vithin \pm 10\% \\ F(Y5V) \\ Vithin \pm 20\% \\ \hline Within \pm 20\% \\ \hline Within \pm 10\% \\ F(Y5V) \\ Vithin \pm 20\% \\ \hline Within \pm 10\% \\ F(Y5V) \\ Within \pm 20\% \\ \hline Within \pm 10\% \\ F(Y5V) \\ Within \pm 20\% \\ \hline Within \pm 20\% \\ \hline Within \pm 20\% \\ \hline Within \pm 10\% \\ F(Y5V) \\ Within \pm 20\% \\ \hline Within the specified initial value \\ \hline Within the specified initial value \\ \hline Mithin the specified initial value \\ \hline Within the specified initial value$				Charact	eristics	Capacitance Change					
$12 Vibration \\ Test Q \\ (Class I) Vibin the specified initial value \\ \hline Capacitance \\ II Insulation \\ \hline II Insulation \\ \hline Capacitance \\ II Insulation \\ \hline II Insulation \\ \hline Capacitance \\ II Insulation \\ \hline II II II II II II II $						Within ±2.5% or		-			
12 Vibration Test $ \begin{array}{c c c c c c c c c c c c c c c c c c c $				Clas	s I	$\pm 0.25\mathrm{pF}$ whichever is					
12 Vibration Test $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			Capacitance			larger					
12 Vibration I X(X6S) Within ±10% Repeat this for 2hours each in 3 mutually perpendicular directions 12 Test I X(X6S) Within ±10% Perpendicular directions Q Within the specified initial value Vithin ±20% Perpendicular directions I Tan δ Within the specified initial value Perpendicular directions Insulation Within the specified initial value Perpendicular directions						Within ±5%			-		
Test Image: Class I (Class I) Mithin the specified initial value perpendicular directions Q (Class I) Within the specified initial value Perpendicular directions Tan δ (Class I) Within the specified initial value Perpendicular directions Insulation Within the specified initial value Perpendicular directions	12	Vibration					Repeat this	for 2hours eacl	n in 3 mutually		
Q Within the specified initial value (Class I) Within the specified initial value Tan & Within the specified initial value (Class I) Insulation	12	Test		Ш			perpendicula	r directions			
(Class I) Within the specified initial value Tan δ Within the specified initial value (Class I) Within the specified initial value					F(Y5V)	vvithin ±20%					
(Class II) Within the specified initial value Insulation Within the specified initial value				Within the	e specified	initial value					
(Class Ⅱ) Insulation Within the specified initial value			Tan δ	M.:		to Martin and the					
Within the specified initial value			(Class II)	VVithin the	e specified	initial value					
Resistance Within the specified initial value			Insulation	M	.,						
			Resistance	VVithin the	e specified	initial value					



	ITE	Μ		PERFOR	RMANCE	TEST CONDITION
		Appearance	No mechanic	al damage shal	occur.	Temperature : 40±2 ℃
				cteristics	Capacitance Change	Relative humidity : 90~95 %RH
					Within ±5.0% or ±0.5pF	Duration time : 500 +12/-0 hr.
			Class I		whichever is larger	
ĺ		Considered				Leave the capacitor in ambient
ĺ		Capacitance		A(X5R)/		condition for specified time* before
			Class	B(X7R)/	Within ±12.5%	measurement.
ĺ			П	X(X6S)		CLASS I : 24±2 Hr.
ĺ				F(Y5V)	Within ±30%	CLASSⅡ : 24±2 Hr.
ĺ		Q	Capacitance	\geq 30pF : Q \geq 3	350	
	Humidity	CLASS I	10≤ Capaci	tance $<30\mathrm{pF}$: Q	\geq 275 + 2.5×C	
13	(Steady				00 + 10×C (C: Capacitance)	_
ĺ	State)		1. Characteri	stic : A(X5R),	2. Characteristic : F(Y5V)	
				B(X7R)		
			0.05max (16)		0.075max (25V and over)	
		Tan ∂	0.075max (10	DV)	0.1max (16V, C<1.0µF)	
		CLASS II	0.075max		$0.125 \max(16V, C \ge 1.0 \mu F)$	
			(6.3V excep	t Table 1)	0.15max (10V)	
			0.125max*		0.195max (6.3V)	
			(refer to Tab	le 1)		
		Insulation	4 000 1/0		· "	
ĺ		Resistance	1,000 M2 or	50MΩ•µF whichev	er is smaller.	
_		Appearance	No mechanic	al damage shal	occur.	Applied Voltage : rated voltage
ĺ			Chara	cteristics	Capacitance Change	Temperature : 40±2 ℃
ĺ					Within ±5.0% or ±0.5pF	Humidity : :90~95%RH
			Cla	ss I	whichever is larger	Duration Time : 500 + 12/-0 Hr.
						Charge/Discharge Current : 50 ^{mA} max.
ļ				A(X5R)/	Within ±12.5%	Perform the initial measurement according to
ļ		Capacitance		B(X7R)/	Within ±12.5%	Note1.
				X(X6S)	Within ±30%	-
			Class II		Within ±30%	_
				F(Y5V)		Perform the final measurement according to
					Within ±30%	Note2.
						-
ĺ	Moisture	Q	Capacitance	\geq 30 pF : Q \geq 20	00	
14	Resistance	(Class I)	Capacitance	<30 pF : Q≥ 10	0 + 10/3×C (C: Capacitance)	
			1 Charactari	atio : A(XED)	2. Characteristic : F(Y5V)	-
			1. Characteri	stic:A(X5R), B(X7R)	2. Characteristic . F(15V)	
ĺ			0.05max (16)		0.075max (25V and over)	
			0.075max (10	,	0.075 max (25 v and over) 0.1max (16V, C<1.0 μ F)	
				, v j	$0.1125 \text{max}(16V, C \ge 1.0 \mu F)$	
		Tan ∂	0.075max	(T-b)- ()	$0.125 \max(16V, C \ge 1.0 \mu)$ 0.15 max (10V)	
		(Class Ⅱ)	(6.3V excep	t lable 1)	0.195max (6.3V)	
			0.125max*		0.100max (0.0V)	
ſ			(refer to Tal	ble 1)		
			X(X6S) 0.11r	nax (6.3V and b	elow)	
			X(X6S) 0.11max (6.3V and below)			
		Insulation				-



NO	ITEM PERFORMANCE				TEST CONDIT	ION					
		Appearance	No mechanio	cal damage :	shall occur.			Itage : 200%* of the re : max. operating t	-		
			Charact	eristics	Capacitan	ce Change	Duration Time : 1000 +48/-0 Hr.				
			Class	s I	Within $\pm 3\%$ or $\pm 0.3 \text{ pF}$,		Charge/Dis	charge Current : 50	A max.		
					Whichever is larger		* refer to table(3) : 150%/100% of the rated				
		Capacitance		A(X5R)/ B(X7R)	Within ±12.5%		voltage				
			Class II	X(X6S)	Within ±25%		Perform the	e initial measurement	according to		
				F(Y5V)	Within ±30%		Note1 for	Class II			
					Within ±30%						
		Q	Capacitance	Capacitance \geq 30pF : Q \geq 350				e final measurement	according to		
		(Class I)			: Q ≥ 275 -		Note2.				
	High		-		$\geq 200 + 10 \times C (C)$						
15	Temperature		1. Characteri	B(X7R)		ristic: F(Y5V)					
	Resistance		0.05max	D(XIII)	0.075max						
			(16V and o	ver)	(25V and	over)					
		Tan∂ (Class Ⅱ)	0.075max (1	,	0.1max(16V	,					
			Tan δ	0.075max		0.125max(16V, C≥1.0μF)					
			(6.3V excep	ot Table 1)	0.15max (10	OV)					
			0.125max*		0.195max (6	6.3V)					
			(refer to Ta	ble 1)							
			X(X6S) 0.11	max (6.3V a	nd below)						
		Insulation Resistance	1,000 MΩ or	50MΩ•µF whic	hever is smalle	r.					
		Appearance	No mechanio	cal damage	shall occur.			shall be subjected	d to 5 cycles.		
			Charact	eristics	Capacitan	ce Change		for 1 cycle :			
			Class	s I	Within ±2.5% (or ±0.25 pF	Step		Time(min.)		
		Capacitance		A(X5R)/	Whichever is la	arger	1	Min. operating temp.+0/-3	30		
			Class	B(X7R)/	Within ±7.5%		2	25	2~3		
16	Temperature Cycle		Π	X(X6S)	Within ±15%		3	Max. operating temp.+3/-0	30		
	-,			F(Y5V)	Within ±20%		4	25	2~3		
		Q (Class I)	Within the s	pecified initia	l value			e capacitor in amb			
		Tan δ	\\//##=:#		Luchus		for specif	ied time* before m	neasurement		
		(Class Ⅱ)	Within the s	pecified initia	i value		* 24 ± 2	hours (Class I)			
		Insulation	Within the -	opoifind initia			24 ± 2	hours (Class ${\rm II}$)			
		Resistance	Within the s								



SAMSUNG ELECTRO-MECHANICS

RELIABILTY TEST CONDITION

		Reco	ommended Sold	ering Method				
		Size	Temperature		Condition			
		inch (mm)	Characteristic	Capacitance	Flow	Reflow		
		0201 (0603)	-	-	-	0		
		0402 (1005)						
			Class I	-	0	0		
		0603 (1608)	Class II	$C < 1\mu F$	0	0		
			Class II	$C \geq 1 \mu F$	-	0		
	Recommended Soldering Method		Class I	-	0	0		
18		0805 (2012)	Class II	C < 4.7µF	0	0		
	By Size & Capacitance	0005 (2012)	Class II	$C \geq 4.7 \mu F$	-	0		
			Array	-	-	0		
			Class I	-	0	0		
		4200 (224.0)	Class II	C < 10 µF	0	0		
		1206 (3216)	Class II	$C \geq 10 \mu F$	-	0		
			Array	-	-	0		
		1210 (3225)				0		
		1808 (4520)				0		
		1812 (4532)] -	-	-	0		
		2220 (5750)				0		

Note1. Initial Measurement For Class ${\ensuremath{\mathbb I}}$

Perform the heat treatment at $150^{\circ}+0/10^{\circ}$ 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 ${\rm I\hspace{-0.2em}I}$

Perform the heat treatment at 150 $^\circ\!\!\!\mathbb{C}$ +0/-10 $^\circ\!\!\!\mathbb{C}$ for 1 hour. Then Leave the capacitor in ambient condition for 48±4 hours before measurement. Then perform the measurement.

*Table1.	
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*Table3.

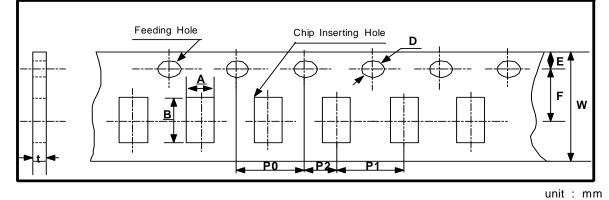
Tan δ	0.125max*	High Tem	perature Resistance test			High Temperature Resi	stance test
	0201 C \geq 0.022 μ F	⊿C (Y5V)	± 30%		Applied	100% of the rated	150% of the rated
	0402 C \geq 0.22 μ F		0402 C \geq 0.47 μ F		Voltage	voltage	voltage
	0603 C $\ge 2.2\mu F$ 0805 C $\ge 4.7\mu F$		0603 C \geq 2.2 μ F			0201 C \geq 0.1 μ F	0201 C \geq 0.022 μ F
Class II	1206 C ≥ 10.0μF	Class ∏ F(Y5V)	0805 C \geq 4.7 μ F		Class II	0402 C \geq 1.0 μ F	0402 C \geq 0.47 μ F
A(X5R),			$1206 \text{ C} \ge 10.0 \mu\text{F}$ $1210 \text{ C} \ge 22.0 \mu\text{F}$		A(X5R),	0603 C \geq 4.7 μ F	0603 C \geq 2.2 μ F
B(X7R)			$1210 \text{ C} \ge 22.0 \mu\text{I}$ 1812 $\text{C} \ge 47.0 \mu\text{F}$		B(X7R),	$0805 C \geq 22.0 \mu F$	0805 C \ge 4.7 μ F
	2220 C ≥100.0μF		$2220 \text{ C} \ge 100.0 \mu\text{F}$		X(X6S),	1206 C \geq 47.0 μ F	1206 C \geq 10.0 μ F
	All Low Profile		2220 C = 100.0µ		F(Y5V)	1210 C \geq 100.0 μ F	1210 C \geq 22.0 μ F
	Capacitors (P.16).					All Low Profile	1812 C \geq 47.0 μ F
	Capacitors (1.10).					Capacitors (P.16).	2220 C \geq 100.0 μ F

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



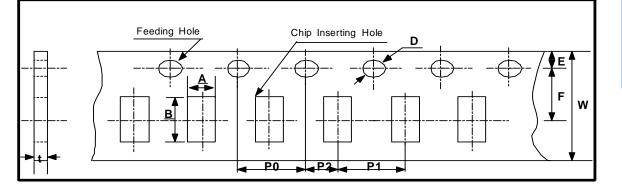
PACKAGING

• CARDBOARD PAPER TAPE (4mm)



Symbol Type		Α	В	w	F	E	P1	P2	P0	D	t
D i m	0603 (1608)	1.1 ±0.2	1.9 ±0.2								
e n s	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	Ф1.5 +0.1/-0	1.1 Below
i o n	1206 (3216)	2.0 ±0.2	3.6 ±0.2								

• CARDBOARD PAPER TAPE (2mm)

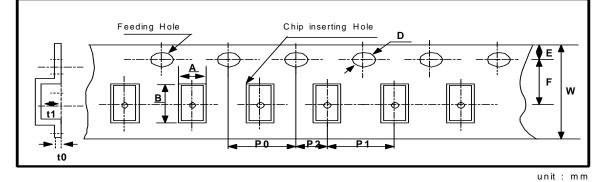


										u	nit:mm
Symbol Type		Α	В	w	F	E	P1	P2	P0	D	t
D i m e	0201 (0603)	0.38 ±0.03	0.68 ±0.03	8.0	3.5 ±0.05	1.75 ±0.1	2.0 ±0.05	2.0 ±0.05	4.0 ±0.1	Ф1.5	0.37 ±0.03
n s i o n	0402 (1005)	0.62 ±0.04	1.12 ±0.04	±0.3						+0.1/-0.03	0.6 ±0.05



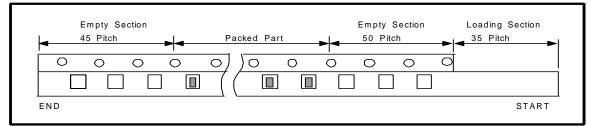
PACKAGING

EMBOSSED PLASTIC TAPE



	vm bol ype	Α	в	w	F	E	P1	P 2	P 0	D	t1	t0
	0805 (2012)	1.45 ±0.2	2.3 ±0.2									
D	1206 (3216)	1.9 ±0.2	3.5 ±0.2	8.0 ±0.3	3.5 ±0.05		4.0 ±0.1				2.5 max	
m e	1210 (3225)	2.9 ±0.2	3.7 ±0.2			1.75		2.0	4.0	Ф1.5 +0.1/-0		0.6
n s i	1808 (4520)	2.3 ±0.2	4.9 ±0.2			±0.1		±0.05	±0.1	+0.17-0		Below
o n	1812 (4532)	3.6 ±0.2	4.9 ±0.2	12.0 ±0.3	5.60 ±0.05		8.0 ±0.1				3.8 max	
	2220 (5750)	5.5 ±0.2	6.2 ±0.2									

• TAPING SIZE

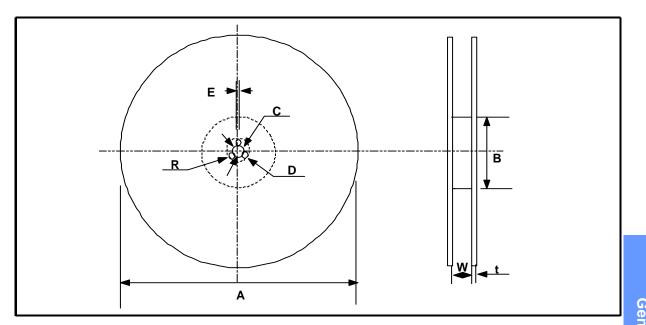


Туре	Symbol	Size	Cardboard Paper Tape	Symbol	Size	Embossed Plastic Tape
		0201(0603)	10,000		All Size ≤ 3216 1210(3225),1808(4520) (t≤1.6mm)	2,000
7" Reel	С	0402(1005)	10,000	E	1210(3225)(t≥2.0mm)	1,000
		OTHERS	4,000		1808(4520)(t≥2.0mm)	1,000
10" Reel	0	-	10,000	-	-	-
	D 0402(1005) 50,000 OTHERS 10,000 0603(1608) 10,000 or 15,000 0805(2012) 15,000 or (t≤0.85mm) 10,000(Option) 1206(3216) 10,000 (t≤0.85mm) 10,000	0402(1005)	50,000		All Size ≤ 3216 1210(3225),1808(4520) (t<1.6mm)	10,000
			$1210(3225)(1.6 \le t < 2.0 \text{ mm})$ $1206(3216)(1.6 \le t)$	8,000		
13" Reel		0603(1608)	10,000 or 15,000	F	1210(3225),1808(4520) (t \ge 2.0mm)	4,000
					1812(4532)(t≤2.0mm)	4,000
		1206(3216)			1812(4532)(t>2.0mm) 5750(2220)	2,000



PACKAGING

• REEL DIMENSION



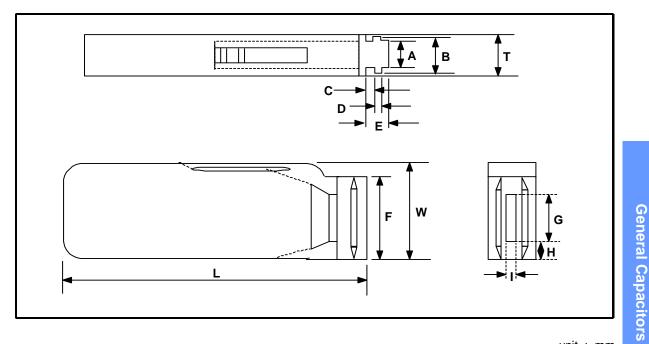
unit : mm

Symbol	Α	В	С	D	E	W	t	R
7" Reel	¢180+0/ -3	¢60+1/ -3			00105	0 4 5	1.2±0.2	1.0
13" Reel	\$330±2.0	ф80 + 1/ -3	¢13±0.3	25±0.5	2.0±0.5	9±1.5	2.2±0.2	1.0



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	Α	В	Т	С	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	Н	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)
 T=0.65mm
 T=0.85mm

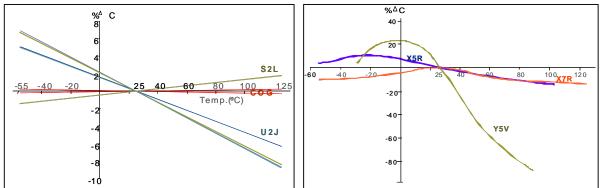
 Quantity
 50,000
 10,000 or 15,000
 10,000
 5,000 or 10,000



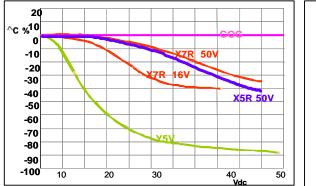
APPLICATION MANUAL

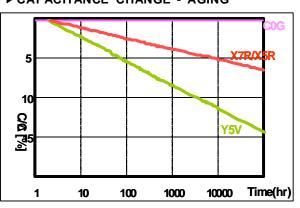
ELECTRICAL CHARACTERISTICS

► CAPACITANCE - TEMPERATURE CHARACTERISTICS



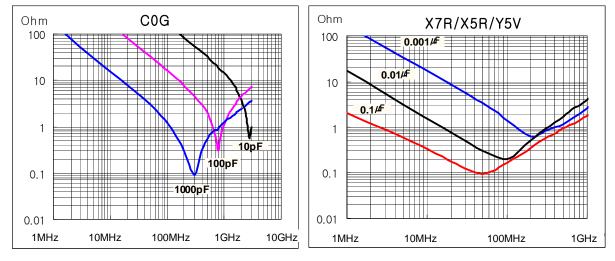
► CAPACITANCE - DC VOLTAGE CHARACTERISTICS ► CAPACITANCE CHANGE - AGING





General Capacitors

▶ IMPEDANCE - FREQUENCY CHARACTERISTICS





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 $^{\circ}$ 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.

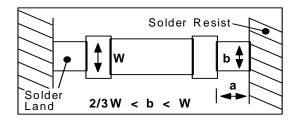
The amount of solder at the end terminations has a direct effect on the crack.

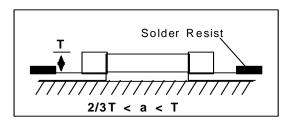
The crack in MLCC will be easily occurred by the tensile stress which was due to too much amount

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.

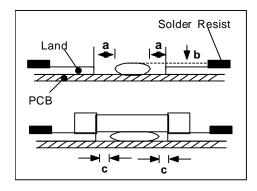
They should not spread or run when applied to the circuit board.

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
Туре	21	31
а	0.2 min	0.2 min
b	70~100 ^{µm}	70~100 ^{µm}
С	> 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

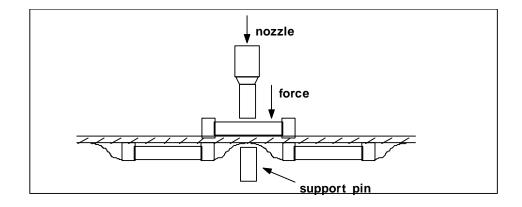
Excessive pressure will cause crack to MLCCs. The pressure of nozzle will be 300g maximum during mounting.



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($\triangle T$) must be less than 100 °C

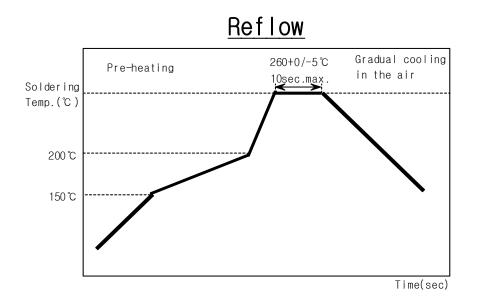
Cleaning

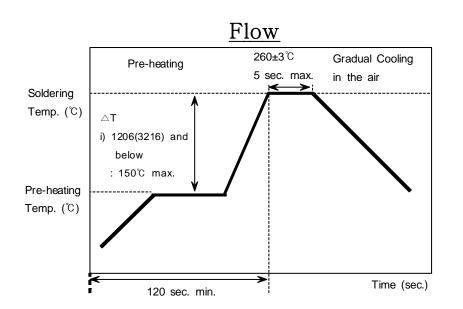
If rosin flux is used, cleaning usually is unnecessary. When strongly activated flux is used, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the chip capacitors. This means that the cleaning fluid must be carefully selected, and should always be new.

▶ 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 often circuit board.

Recommended Soldering Profile





The Inside Edge

Soldering Iron

Variation of Temp.	Soldering	Pre-heating	Soldering	Cooling
	Temp (°C)	Time (Sec)	Time(Sec)	Time(Sec)
∆T≤130	300±10℃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.

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