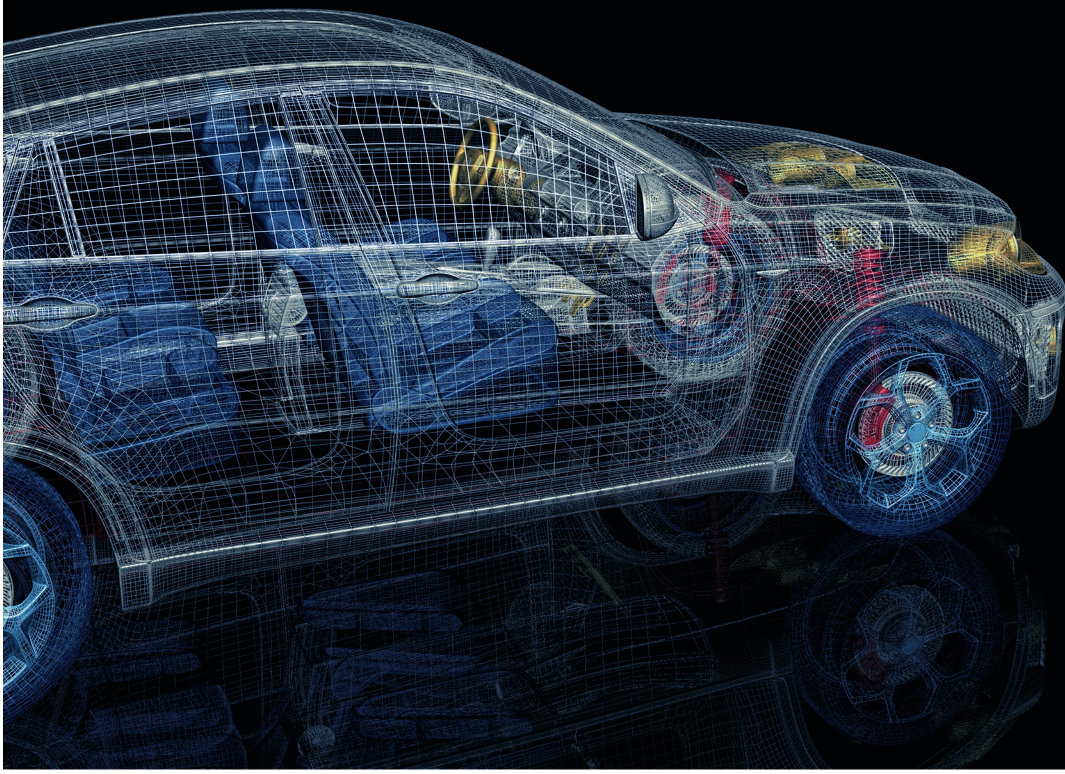
November 2019

RoHS+Halogen Compliant

MULTILAYER CERAMIC CAPACITORS for AUTOMOTIVE



To ensure safe drive

SAMSUNG ELECTRO-MECHANICS

SAMSUNG

Premium Capacitors for Automotive Applications

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

1 SERIES CODE

CL = Multilayer Ceramic Capacitors

2 SIZE CODE

Code	inch(mm)	Code	inch(mm)	Code	inch(mm)
05	0402(1005)	21	0805(2012)	32	1210(3225)
10	0603(1608)	31	1206(3216)		

3 DIELECTRIC CODE

Class I

Symbol	EIA Code	Operation Temperature Range(°C)	Temperature Coeffcient(ppm / °C)
C	C0G	-55 ~ +125	0 ± 30

Class II

Symbol	EIA Code	Operation Temperature Range(°C)	Capacitance Change(ΔC %)
B	X7R	-55 ~ +125	± 15
Y	X7S	-55 ~ +125	± 22
Z	X7T	-55 ~ +125	-33 ~ +22

4 CAPACITANCE CODE

Capacitance expressed in pF. 2 significant digits plus number of zeros.

example) 106=10×10^6=10,000,000pF

For Values < 10pF, Letter R denotes decimal point

example) 1R5 =1.5pF

5 TOLERANCE CODE

Capacitance Tolerance

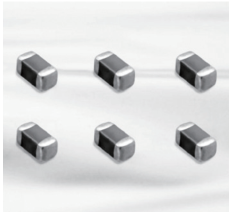
Code	Capacitance Tolerance	TC	Capacitance series	Remark
C	± 0.25pF	C0G	E-12 series*	under 5pF
D	± 0.5pF	C0G	E-12 series*	5pF < Cp < 10pF
J	± 5%	C0G	E-12 series	≥10pF
K	± 10%	X7R/X7S	E-6 series	
M	± 20%	X7R/X7S	E-6 series	

* E-24 series is also available
※ This code has only typical specifications. Please refer to individual specifications.

Code	Capacitance Step											
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	1.1	1.2	1.3	2.2	2.4	2.7	3.0	4.7	5.1	5.6	6.2
	1.5	1.6	1.8	2.0	3.3	3.6	3.9	4.3	6.8	7.5	8.2	9.1

General Automotive Capacitors

Feature

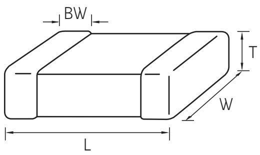


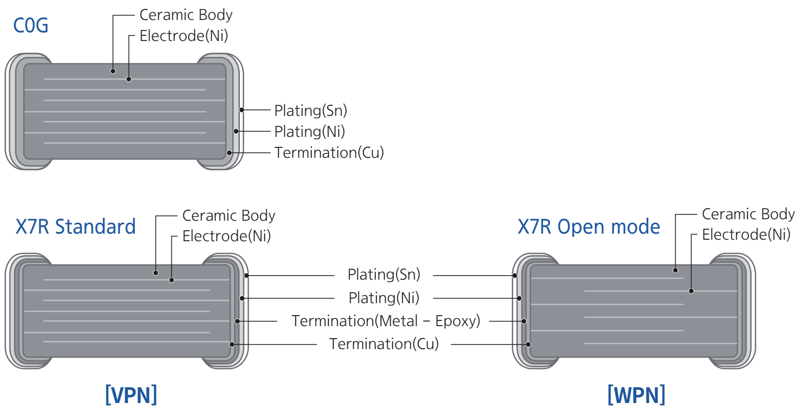
- Automotive products are manufactured in state of the art facilities recommend for registration to ISO 9001 & IATF 16949.
- Automotive products meet AEC-Q200 requirements.
- Automotive products are RoHS compliant.
- Automotive products meet JEDEC-020-D requirements.
- X7R dielectric components have BME and metal-epoxy terminations with a Ni/Sn plated overcoat.
- C0G dielectric components contain BME and copper terminations with a Ni/Sn plated overcoat.
  Size 0603/0805/1206 is suitable for flow and reflow soldering.
  Size 0402 and smaller (≤0402) and 1210 and bigger (≥1210) is suitable for reflow soldering.

Application

- Automotive Electronic Equipment
  (Powertrain, Safety, Body & Chassis, Convenience, Infotainment)

Structure and Dimensions





Size Code	EIA Code	Dimension(mm)			
		L	W	T	BW
05	0402	1.00±0.05	0.50±0.05	0.50±0.05	0.25±0.10
10	0603	1.60±0.10	0.80±0.10	0.80±0.10	0.30±0.20
21	0805	2.00±0.10	1.25±0.10	1.25±0.10	0.5+0.2/-0.3
		2.00±0.15	1.25±0.15	1.25±0.15	
31	1206	3.20±0.20	1.60±0.20	1.60±0.20	0.5±0.3
32	1210	3.20±0.30	2.50±0.20	2.00±0.20	0.6±0.3
				2.50±0.20	

Automotive Capacitance Table (C0G)

Size inch (mm)	Thickness (mm)	Rated Voltage (Vdc)	Capacitance											
			pF			nF								
			100	220	470	1	2.2	4.7	10	22	47	100	220	
0402 (1005)	0.50	50	■	■										
		100	■											
0603 (1608)	0.80	50	■	■	■	■								
		100	■	■ 270										
0805 (2012)	0.60 0.85 1.25	50	■	■	■	■	■	■	■					
		100	■	■	■	■								

General Automotive Capacitors

Product Line up (Automotive Capacitors_ C0G)

■ Size : 1.00×0.50mm (inch : 0402)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	0.55	50	COG	1pF	±0.25pF	CL05C010CB51PN□	
2	0.55	50	COG	1.2pF	±0.25pF	CL05C1R2CB51PN□	
3	0.55	50	COG	1.2pF	±0.1%	CL05C1R2BB51PN□	
4	0.55	50	COG	1.5pF	±0.25pF	CL05C1R5CB51PN□	
5	0.55	50	COG	1.5pF	±0.1%	CL05C1R5BB51PN□	
6	0.55	50	COG	1.8pF	±0.1%	CL05C1R8BB51PN□	
7	0.55	50	COG	2pF	±0.1%	CL05C020BB51PN□	
8	0.55	50	COG	2.2pF	±0.25pF	CL05C2R2CB51PN□	
9	0.55	50	COG	3pF	±0.25pF	CL05C030CB51PN□	
10	0.55	50	COG	3.3pF	±0.1%	CL05C3R3BB51PN□	
11	0.55	50	COG	3.9pF	±0.25pF	CL05C3R9CB51PN□	
12	0.55	50	COG	4pF	±0.25pF	CL05C040CB51PN□	
13	0.55	50	COG	4.7pF	±0.25pF	CL05C4R7CB51PN□	
14	0.55	50	COG	5pF	±0.25pF	CL05C050CB51PN□	
15	0.55	50	COG	5pF	±0.5pF	CL05C050DB51PN□	
16	0.55	50	COG	5.6pF	±0.25pF	CL05C5R6CB51PN□	
17	0.55	50	COG	6pF	±0.25pF	CL05C060CB51PN□	
18	0.55	50	COG	6pF	±0.5pF	CL05C060DB51PN□	
19	0.55	50	COG	6.8pF	±0.5pF	CL05C6R8DB51PN□	
20	0.55	50	COG	6.8pF	±0.25pF	CL05C6R8CB51PN□	
21	0.55	50	COG	8pF	±0.5pF	CL05C080DB51PN□	
22	0.55	50	COG	8.2pF	±0.25pF	CL05C8R2CB51PN□	
23	0.55	50	COG	8.2pF	±0.1%	CL05C8R2BB51PN□	
24	0.55	50	COG	9pF	±0.25pF	CL05C090CB51PN□	
25	0.55	50	COG	9pF	±0.5pF	CL05C090DB51PN□	
26	0.55	50	COG	10pF	±2%	CL05C100GB51PN□	
27	0.55	50	COG	10pF	±5%	CL05C100JB51PN□	
28	0.55	50	COG	12pF	±5%	CL05C120JB51PN□	
29	0.55	50	COG	15pF	±5%	CL05C150JB51PN□	
30	0.55	50	COG	18pF	±5%	CL05C180JB51PN□	
31	0.55	50	COG	20pF	±2%	CL05C200GB51PN□	
32	0.55	50	COG	22pF	±5%	CL05C220JB51PN□	
33	0.55	50	COG	27pF	±5%	CL05C270JB51PN□	
34	0.55	50	COG	20pF	±5%	CL05C200JB51PN□	
35	0.55	50	COG	33pF	±5%	CL05C330JB51PN□	
36	0.55	50	COG	39pF	±5%	CL05C390JB51PN□	
37	0.55	50	COG	47pF	±5%	CL05C470JB51PN□	
38	0.55	50	COG	56pF	±5%	CL05C560JB51PN□	
39	0.55	50	COG	68pF	±5%	CL05C680JB51PN□	
40	0.55	50	COG	68pF	±1%	CL05C680FB51PN□	
41	0.55	50	COG	82pF	±5%	CL05C820JB51PN□	
42	0.55	50	COG	100pF	±5%	CL05C101JB51PN□	
43	0.55	50	COG	120pF	±5%	CL05C121JB51PN□	
44	0.55	50	COG	150pF	±5%	CL05C151JB51PN□	
45	0.55	50	COG	150pF	±1%	CL05C151FB51PN□	
46	0.55	50	COG	220pF	±5%	CL05C221JB51PN□	
47	0.55	100	COG	2.2pF	±0.25pF	CL05C2R2CC51PN□	
48	0.55	100	COG	4.7pF	±0.25pF	CL05C4R7CC51PN□	
49	0.55	100	COG	10pF	±5%	CL05C100JC51PN□	
50	0.55	100	COG	12pF	±5%	CL05C120JC51PN□	
51	0.55	100	COG	15pF	±5%	CL05C150JC51PN□	
52	0.55	100	COG	18pF	±5%	CL05C180JC51PN□	
53	0.55	100	COG	22pF	±5%	CL05C220JC51PN□	
54	0.55	100	COG	27pF	±5%	CL05C270JC51PN□	
55	0.55	100	COG	33pF	±5%	CL05C330JC51PN□	
56	0.55	100	COG	39pF	±5%	CL05C390JC51PN□	
57	0.55	100	COG	47pF	±5%	CL05C470JC51PN□	
58	0.55	100	COG	56pF	±5%	CL05C560JC51PN□	
59	0.55	100	COG	68pF	±5%	CL05C680JC51PN□	
60	0.55	100	COG	82pF	±5%	CL05C820JC51PN□	
61	0.55	100	COG	100pF	±5%	CL05C101JC51PN□	

General Automotive Capacitors

Product Line up (Automotive Capacitors_ C0G)

■ Size : 1.60×0.80mm (inch : 0603)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
62	0.90	100	COG	15pF	±5%	CL10C150JC81PN□	
63	0.90	100	COG	18pF	±5%	CL10C180JC81PN□	
64	0.90	100	COG	20pF	±5%	CL10C200JC81PN□	
65	0.90	100	COG	27pF	±5%	CL10C270JC81PN□	
66	0.90	100	COG	39pF	±5%	CL10C390JC81PN□	
67	0.90	100	COG	47pF	±5%	CL10C470JC81PN□	
68	0.90	100	COG	50pF	±5%	CL10C500JC81PN□	
69	0.90	100	COG	56pF	±5%	CL10C560JC81PN□	
70	0.90	100	COG	82pF	±5%	CL10C820JC81PN□	
71	0.90	100	COG	100pF	±5%	CL10C101JC81PN□	
72	0.90	100	COG	120pF	±5%	CL10C121JC81PN□	
73	0.90	100	COG	150pF	±5%	CL10C151JC81PN□	
74	0.90	100	COG	180pF	±5%	CL10C181JC81PN□	
75	0.90	100	COG	220pF	±5%	CL10C221JC81PN□	

■ Size : 2.00×1.25mm (inch : 0805)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	1.35	50	COG	1nF	±5%	CL21C102JBF1PN□	
2	1.35	50	COG	1.8nF	±5%	CL21C182JBF1PN□	
3	1.35	50	COG	2.2nF	±5%	CL21C222JBF1PN□	
4	1.35	50	COG	3.3nF	±5%	CL21C332JBF1PN□	
5	1.35	50	COG	4.7nF	±5%	CL21C472JBF1PN□	
6	1.35	50	COG	6.8nF	±5%	CL21C682JBF1PN□	
7	1.35	50	COG	8.2nF	±5%	CL21C822JBF1PN□	
8	1.35	50	COG	10nF	±5%	CL21C103JBF1PN□	
9	1.35	100	COG	1nF	±5%	CL21C102JCF1PN□	

General Automotive Capacitors

Product Line up (Automotive Capacitors_X7R/X7S/X7T)

■ Size : 1.60×0.80mm (inch : 0603)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	0.90	6.3	X7R	1uF	±10%	CL10B105KQ8VPN□	
2	1.00	6.3	X7T	4.7uF	±20%	CL10Z475MQ9VPN□	
3	0.90	10	X7R	220nF	±10%	CL10B224KP8VPN□	
4	0.90	10	X7R	470nF	±10%	CL10B474KP8VPN□	
5	0.90	10	X7R	680nF	±10%	CL10B684KP8VPN□	
6	0.90	10	X7R	1uF	±10%	CL10B105KP8VPN□	
7	0.90	10	X7S	2.2uF	±10%	CL10Y225KP84PN□	
8	0.90	16	X7R	68nF	±10%	CL10B683KO8WPN□	
9	0.90	16	X7R	100nF	±10%	CL10B104KO8WPN□	
10	0.90	16	X7R	150nF	±10%	CL10B154KO8VPN□	
11	0.90	16	X7R	220nF	±10%	CL10B224KO8VPN□	
12	0.90	16	X7R	270nF	±10%	CL10B274KO8VPN□	
13	0.90	16	X7R	330nF	±10%	CL10B334KO8VPN□	
14	0.90	16	X7R	470nF	±10%	CL10B474KO8VPN□	
15	0.90	16	X7R	680nF	±10%	CL10B684KO8VPN□	
16	0.90	16	X7R	1uF	±10%	CL10B105KO8VPN□	
17	0.90	25	X7R	1nF	±10%	CL10B102KA8WPN□	
18	0.90	25	X7R	1.5nF	±10%	CL10B152KA8WPN□	
19	0.90	25	X7R	2.2nF	±10%	CL10B222KA8WPN□	
20	0.90	25	X7R	3.3nF	±10%	CL10B332KA8WPN□	
21	0.90	25	X7R	4.7nF	±10%	CL10B472KA8WPN□	
22	0.90	25	X7R	6.8nF	±10%	CL10B682KA8WPN□	
23	0.90	25	X7R	10nF	±10%	CL10B103KA8WPN□	
24	0.90	25	X7R	15nF	±10%	CL10B153KA8WPN□	
25	0.90	25	X7R	22nF	±10%	CL10B223KA8WPN□	
26	0.90	25	X7R	33nF	±10%	CL10B333KA85PN□	
27	0.90	25	X7R	47nF	±10%	CL10B473KA85PN□	
28	0.90	25	X7R	100nF	±10%	CL10B104KA8WPN□	
29	0.90	25	X7R	100nF	±10%	CL10B104KA8VPN□	
30	0.90	25	X7R	150nF	±10%	CL10B154KA8VPN□	
31	0.90	25	X7R	220nF	±10%	CL10B224KA8VPN□	
32	0.90	25	X7R	330nF	±10%	CL10B334KA8VPN□	
33	0.90	25	X7R	470nF	±10%	CL10B474KA8VPN□	
34	0.90	25	X7R	680nF	±10%	CL10B684KA8VPN□	
35	0.90	25	X7R	1uF	±10%	CL10B105KA8VPN□	
36	0.90	50	X7R	220pF	±10%	CL10B221KB8WPN□	
37	0.90	50	X7R	470pF	±10%	CL10B471KB8WPN□	
38	0.90	50	X7R	1nF	±10%	CL10B102KB8WPN□	
39	0.90	50	X7R	1nF	±5%	CL10B102JB8WPN□	
40	0.90	50	X7R	1.5nF	±10%	CL10B152KB8WPN□	
41	0.90	50	X7R	1.8nF	±10%	CL10B182KB8WPN□	
42	0.90	50	X7R	2.2nF	±10%	CL10B222KB8WPN□	
43	0.90	50	X7R	2.7nF	±10%	CL10B272KB8WPN□	
44	0.90	50	X7R	3.3nF	±10%	CL10B332KB8WPN□	
45	0.90	50	X7R	3.9nF	±10%	CL10B392KB8WPN□	
46	0.90	50	X7R	4.7nF	±10%	CL10B472KB8WPN□	
47	0.90	50	X7R	4.7nF	±5%	CL10B472JB8WPN□	
48	0.90	50	X7R	4.7nF	±5%	CL10B472JB8VPN□	
49	0.90	50	X7R	5.6nF	±10%	CL10B562KB8WPN□	
50	0.90	50	X7R	6.8nF	±10%	CL10B682KB8WPN□	
51	0.90	50	X7R	8.2nF	±10%	CL10B822KB8WPN□	
52	0.90	50	X7R	10nF	±10%	CL10B103KB8WPN□	
53	0.90	50	X7R	15nF	±10%	CL10B153KB8WPN□	
54	0.90	50	X7R	22nF	±10%	CL10B223KB8WPN□	
55	0.90	50	X7R	27nF	±10%	CL10B273KB8WPN□	
56	0.90	50	X7R	33nF	±10%	CL10B333KB8WPN□	
57	0.90	50	X7R	39nF	±10%	CL10B393KB8WPN□	
58	0.90	50	X7R	47nF	±10%	CL10B473KB8WPN□	
59	0.90	50	X7R	56nF	±10%	CL10B563KB8WPN□	
60	0.90	50	X7R	68nF	±10%	CL10B683KB8WPN□	
61	0.90	50	X7R	82nF	±10%	CL10B823KB8WPN□	

General Automotive Capacitors

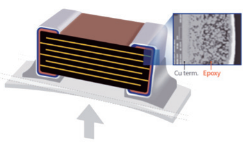
Product Line up (Automotive Capacitors_X7R/X7S/X7T)

■ Size : 2.00×1.25mm (inch : 0805)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	1.40	6.3	X7R	4.7uF	±10%	CL21B475KQQVPN□	
2	1.40	6.3	X7S	10uF	±10%	CL21Y106KQQVPN□	
3	1.35	10	X7R	1uF	±10%	CL21B105KPFVPN□	
4	1.35	10	X7R	2.2uF	±10%	CL21B225KPFVPN□	
5	1.40	10	X7R	4.7uF	±10%	CL21B475KPQVPN□	
6	1.40	10	X7S	10uF	±10%	CL21Y106KPQVPN□	
7	1.35	16	X7R	150nF	±10%	CL21B154KOFVPN□	
8	1.35	16	X7R	220nF	±10%	CL21B224KOFVPN□	
9	1.35	16	X7R	270nF	±10%	CL21B274KOFVPN□	
10	1.35	16	X7R	330nF	±10%	CL21B334KOFVPN□	
11	1.35	16	X7R	390nF	±10%	CL21B394KOFVPN□	
12	1.35	16	X7R	470nF	±10%	CL21B474KOFVPN□	
13	1.35	16	X7R	680nF	±10%	CL21B684KOFVPN□	
14	1.35	16	X7R	1uF	±10%	CL21B105KOFVPN□	
15	1.35	16	X7R	2.2uF	±10%	CL21B225KOFVPN□	
16	1.40	16	X7R	2.2uF	±10%	CL21B225KOQVPN□	
17	1.40	16	X7R	3.3uF	±10%	CL21B335KOQVPN□	
18	1.40	16	X7R	4.7uF	±10%	CL21B475KOQVPN□	
19	1.40	16	X7S	10uF	±10%	CL21Y106KOQ4PN□	
20	1.35	25	X7R	150nF	±10%	CL21B154KAFVPN□	
21	1.35	25	X7R	220nF	±10%	CL21B224KAFVPN□	
22	1.35	25	X7R	330nF	±10%	CL21B334KAFVPN□	
23	1.35	25	X7R	470nF	±10%	CL21B474KAFVPN□	
24	1.35	25	X7R	560nF	±10%	CL21B564KAFVPN□	
25	1.35	25	X7R	1uF	±10%	CL21B105KAFVPN□	
26	1.35	25	X7R	2.2uF	±10%	CL21B225KAFVPN□	
27	1.35	50	X7R	100nF	±10%	CL21B104KBFWPN□	
28	1.35	50	X7R	120nF	±10%	CL21B124KBFVPN□	
29	1.35	50	X7R	150nF	±10%	CL21B154KBFVPN□	
30	1.35	50	X7R	180nF	±10%	CL21B184KBFVPN□	
31	1.35	50	X7R	220nF	±10%	CL21B224KBFVPN□	
32	1.35	50	X7R	330nF	±10%	CL21B334KBFVPN□	
33	1.35	50	X7R	470nF	±10%	CL21B474KBFVPN□	
34	1.35	50	X7R	680nF	±10%	CL21B684KBFVPN□	
35	1.35	50	X7R	1uF	±10%	CL21B105KBFVPN□	
36	1.35	100	X7R	22nF	±10%	CL21B223KCFWPN□	
37	1.35	100	X7R	47nF	±10%	CL21B473KCFWPN□	
38	1.35	100	X7R	100nF	±10%	CL21B104KCFWPN□	
39	1.40	100	X7R	220nF	±10%	CL21B224KCQVPN□	

Special Automotive Capacitors

Feature

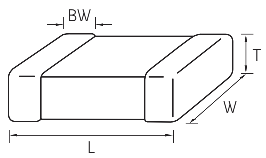


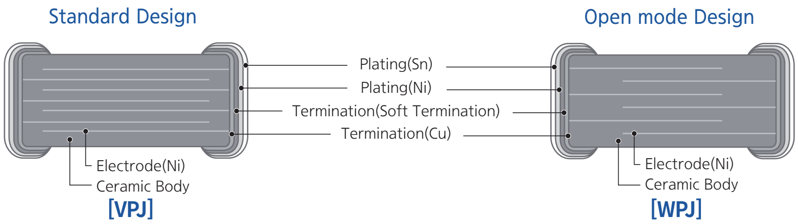
- AEC-Q200 qualified, 5mm bending strength guaranteed.
- Strong thermo-mechanical properties.
- Soft termination has been tested according to the VW 80808-2.

Application

- Critical circuits and battery line circuits.
  (Prevent a module/sub-system failure in the event of a cracked/shorted capacitor)

Structure and Dimensions





Size Code	EIA Code	Dimension(mm)			
		L	W	T	BW
05	0402	1.00±0.10	0.50±0.05	0.50±0.05	0.25±0.10
10	0603	1.60±0.20	0.80±0.10	0.80±0.10	0.30±0.20
21	0805	2.00±0.30	1.25±0.20	0.85±0.10	0.5+0.2/-0.3
				1.25±0.20	
31	1206	3.20±0.30	1.60±0.30	1.60±0.30	0.5±0.3
32	1210	3.20±0.40	2.50±0.30	2.50±0.30	0.6±0.3

High Bending Strength Capacitance Table (X7R/X7S)

Size inch (mm)	Thickness (mm)	Rated Voltage (Vdc)	Capacitance nF 10	22	47	100	220	470	uF 1	2.2	4.7	10	22	47
0402 (1005)	0.50	10	■	■	■	■	X7S	X7S	X7S					
		16	■	■	■	■								
		25	■	■										
		50	■	■										
0603 (1608)	0.80	16	■	■	■	■	■	■	■					
		25	■	■	■	■	■	■	■					
		50	■	■	■	■	■							
		100	■	■	■									
0805 (2012)	1.25	10	■	■	■	■	■	■	■	■	■			
		16	■	■	■	■	■	■	■	■	■			
		25	■	■	■	■	■	■	■	■				
		50	■	■	■	■	■	■	■					
		100	■	■	■	■								
1206 (3216)	1.60	10				■	■	■	■	■	■	■		
		16				■	■	■	■	■	■	■		
		25				■	■	■	■	■	■	■		
		50				■	■	■	■	■	■			
1210 (3225)	2.50	6.3							■	■	■	■	■	X7S
		10							■	■	■	■	■	X7S
		16							■	■	■	■	■	
		25							■	■	■	■	X7S	
		50							■	■	■	■		

Special Automotive Capacitors

Product Line up (High Bending Strength Capacitors)

■ Size : 1.00×0.50mm (inch : 0402)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	0.55	16	X7R	10nF	±10%	CL05B103KO5VPJ□	
2	0.55	16	X7R	22nF	±10%	CL05B223KO5VPJ□	
3	0.55	16	X7R	47nF	±10%	CL05B473KO5VPJ□	
4	0.55	16	X7R	100nF	±10%	CL05B104KO5VPJ□	
5	0.55	25	X7R	22nF	±10%	CL05B223KA5VPJ□	
6	0.55	25	X7R	10nF	±10%	CL05B103KA5VPJ□	
7	0.55	50	X7R	10nF	±10%	CL05B103KB5VPJ□	
8	0.55	50	X7R	22nF	±10%	CL05B223KB5VPJ□	

■ Size : 1.60×0.80mm (inch : 0603)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	0.90	6.3	X7R	1uF	±10%	CL10B105KQ8VPJ□	
2	0.90	10	X7R	1uF	±10%	CL10B105KP8VPJ□	
3	0.90	16	X7R	47nF	±10%	CL10B473KO8VPJ□	
4	0.90	16	X7R	470nF	±10%	CL10B474KO8VPJ□	
5	0.90	16	X7R	1uF	±10%	CL10B105KO8VPJ□	
6	0.90	25	X7R	47nF	±10%	CL10B473KA8VPJ□	
7	0.90	25	X7R	100nF	±10%	CL10B104KA8VPJ□	
8	0.90	25	X7R	1uF	±10%	CL10B105KA8VPJ□	
9	0.90	50	X7R	1nF	±10%	CL10B102KB8WPJ□	
10	0.90	50	X7R	1.5nF	±10%	CL10B152KB8WPJ□	
11	0.90	50	X7R	2.2nF	±10%	CL10B222KB8WPJ□	
12	0.90	50	X7R	4.7nF	±10%	CL10B472KB8WPJ□	
13	0.90	50	X7R	22nF	±10%	CL10B223KB8VPJ□	
14	0.90	50	X7R	33nF	±10%	CL10B333KB8VPJ□	
15	0.90	50	X7R	47nF	±10%	CL10B473KB8VPJ□	
16	0.90	50	X7R	68nF	±10%	CL10B683KB8VPJ□	
17	0.90	50	X7R	100nF	±10%	CL10B104KB8VPJ□	
18	0.90	50	X7R	220nF	±10%	CL10B224KB8VPJ□	
19	0.90	100	X7R	1nF	±10%	CL10B102KC8WPJ□	
20	0.90	100	X7R	2.2nF	±10%	CL10B222KC8WPJ□	
21	0.90	100	X7R	4.7nF	±10%	CL10B472KC8WPJ□	
22	0.90	100	X7R	10nF	±10%	CL10B103KC8WPJ□	
23	0.90	100	X7R	22nF	±10%	CL10B223KC8VPJ□	
24	0.90	100	X7R	47nF	±10%	CL10B473KC8VPJ□	

■ Size : 2.00×1.25mm (inch : 0805)

No.	Thickness Max. (mm)	Rated Voltage (Vdc)	TCC	Capacitance	Capacitance Tolerance	Part Number	Remark
1	1.45	10	X7R	1uF	±10%	CL21B105KPFVPJ□	
2	1.45	16	X7R	1uF	±10%	CL21B105KOFVPJ□	
3	1.45	16	X7R	2.2uF	±10%	CL21B225KOFVPJ□	
4	1.45	16	X7R	4.7uF	±10%	CL21B475KOQVPJ□	
5	1.45	25	X7R	220nF	±10%	CL21B224KAFVPJ□	
6	1.45	25	X7R	1uF	±10%	CL21B105KAFVPJ□	
7	1.45	25	X7R	10uF	±10%	CL21Y106KABVPJ□	
8	1.45	50	X7R	15nF	±10%	CL21B153KBFWPJ□	
9	1.45	50	X7R	22nF	±10%	CL21B223KBFWPJ□	
10	1.45	50	X7R	47nF	±10%	CL21B473KBFWPJ□	
11	1.45	50	X7R	100nF	±10%	CL21B104KBFWPJ□	
12	1.45	50	X7R	220nF	±10%	CL21B224KBFVPJ□	
13	1.45	50	X7R	330nF	±10%	CL21B334KBFVPJ□	
14	1.45	50	X7R	470nF	±10%	CL21B474KBFVPJ□	
15	1.45	50	X7R	1uF	±10%	CL21B105KBFVPJ□	
16	1.45	50	X7R	4.7uF	±10%	CL21Y475KBYVPJ□	
17	1.45	100	X7R	10nF	±10%	CL21B103KCCWPJ□	
18	1.45	100	X7R	47nF	±10%	CL21B473KCFWPJ□	
19	1.45	100	X7R	22nF	±10%	CL21B223KCFWPJ□	
20	1.45	100	X7R	100nF	±10%	CL21B104KCFWPJ□	

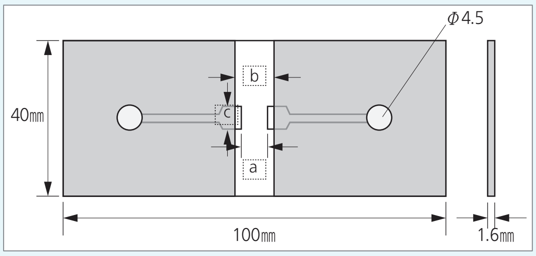
Reliability Test Conditions

No.	Item			Performance	Test condition
1	Pre-and Post-Stress Electrical Test			-	
2	High Temper-ature Exposure	Appearance		No abnormal exterior appearance	Unpowered, 1000hrs@T = 125℃ Initial Measurement Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement. Final Measurement Leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.
		Capacitance Change	Class I	Within±2.5% or ±0.25pF, (Whichever is larger)	
			Class II	Within±10%	
		Q	Class I	Capacitance ≥ 30pF : Q≥ 1,000 < 30pF : Q≥ 400 + 20 X C (C : Capacitance)	
		Tanδ	Class II	Rated Voltage ≥ 25V : 0.030 max ≥ 16V : 0.050 max ≥ 10V : 0.075 max *1)	
		IR		More than 10,000MΩ or 500MΩ X μF (Whichever is smaller) *1)	
3	Temper-ature Cycling	Appearance		No abnormal exterior appearance	1000Cycles Initial Measurement Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement. Final Measurement Leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.
		Capacitance Change	Class I	Within±2.5% or ±0.25pF, (Whichever is larger)	
			Class II	Within±10%	
		Q	Class I	Capacitance ≥ 30pF : Q≥ 1,000 < 30pF : Q≥ 400 + 20 X C (C : Capacitance)	
		Tanδ	Class II	Rated Voltage ≥ 25V : 0.030 max ≥ 16V : 0.050 max ≥ 10V : 0.075 max *1)	
		IR		More than 10,000MΩ or 500MΩ X μF (Whichever is smaller) *1)	
4	Destructive Physical Analysis			No defects or abnormalities	Per EIA 469
5	Biased Humidity	Appearance		No abnormal exterior appearance	1000hrs 85℃ / 85%RH, Rated voltage and 1.3 ~ 1.5V, (add 100kohm resistor) Initial Measurement Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement. Final Measurement Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement
		Capacitance Change	Class I	Within±2.5% or ±0.25pF, (Whichever is larger)	
			Class II	Within±12.5%	
		Q	Class I	Capacitance ≥ 30pF : Q≥ 200 < 30pF : Q≥ 100 + (10/3) X C (C : Capacitance)	
		Tanδ	Class II	Rated Voltage ≥ 25V : 0.035 max ≥ 16V : 0.050 max ≥ 10V : 0.075 max *1)	
		IR		More than 500MΩ or 25MΩ X μF (Whichever is smaller) *1)	
6	High Temper-ature Operating Life	Appearance		No abnormal exterior appearance	1000hrs @ TA=125℃, 200% Rated Voltage, *2) Initial Measurement Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement. Final Measurement Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.
		Capacitance Change	Class I	Within±3.0% or ±0.3pF, (Whichever is larger)	
			Class II	Within±12.5%	
		Q	Class I	Capacitance ≥ 30pF : Q≥ 350 ≥ 10pF : Q≥ 275 + (15 / 2) X C < 10pF : Q≥ 200 + 10 X C (C : Capacitance)	
		Tanδ	Class II	Rated Voltage ≥ 25V : 0.035 max ≥ 16V : 0.050 max ≥ 10V : 0.075 max *1)	
		IR		More than 1,000MΩ or 50MΩ X μF (Whichever is smaller) *1)	
7	External Visual			No abnormal exterior appearance	Microscope (x10)
8	Physical Dimensions			Within the specified dimensions	Using the calipers

Step	Temperature(℃)	Time(min.)
1	Min. operating Temp.+0/ -3	30±3
2	25±2	1
3	Max. operating Temp.+3/ - 0	30±3
4	25±2	1

※ *1) : Indicates typical specification. Please refer to individual specifications.
*2) : Some of the parts are applicable in rated voltage × 150% or × 120%, Please refer to individual specifications.

Reliability Test Conditions

<table>
<tr><th>No.</th><th colspan="3">Item</th><th>Performance</th><th>Test condition</th></tr>
<tr><td rowspan="3">15</td><td rowspan="3">Board Flex</td><td colspan="2">Appearance</td><td>No abnormal exterior appearance</td><td rowspan="3">Bending to the limit for 60 seconds.
Limit : Class Ⅰ - 3mm
Class II - 2mm *1)
(Substrate for board flex test)


[unit : mm]
<table>
<tr><th>Code(Inch)</th><th>Dimension(mm)</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>05(0402)</td><td>1.0 × 0.5</td><td>0.5</td><td>1.5</td><td>0.6</td></tr>
<tr><td>10(0603)</td><td>1.6 × 0.8</td><td>0.6</td><td>2.2</td><td>0.9</td></tr>
<tr><td>21(0805)</td><td>2.0 × 1.25</td><td>0.8</td><td>3.0</td><td>1.3</td></tr>
<tr><td>31(1206)</td><td>3.2 × 1.6</td><td>2.0</td><td>4.4</td><td>1.7</td></tr>
<tr><td>32(1210)</td><td>3.2 × 2.5</td><td>2.0</td><td>4.4</td><td>2.6</td></tr>
</table>
Material: Glass epoxy substrate
Thickness: T=1.6㎜

Initial Measurement
Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.

Final Measurement
Leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.</td></tr>
<tr><td rowspan="2">Capacitance Change</td><td>Class I</td><td>Within±5.0% or ±0.5pF, (Whichever is larger)</td></tr>
<tr><td>Class II</td><td>Within±10%</td></tr>
<tr><td rowspan="3">16</td><td rowspan="3">Terminal Strength (SMD)</td><td colspan="2">Appearance</td><td>No abnormal exterior appearance</td><td rowspan="3">18N, for 60±1 sec.
* 0603(1608) -10N, 0402(1005) -2N

Initial Measurement
Perform the heat treatment at 150℃ +0 / -10℃ for 1 hour and leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.

Final Measurement
Leave the capacitor in ambient condition for 24±2 hours before measurement. Then perform the measurement.</td></tr>
<tr><td rowspan="2">Capacitance Change</td><td>Class I</td><td>Within±2.5% or ±0.25pF, (Whichever is larger)</td></tr>
<tr><td>Class II</td><td>Within±10%</td></tr>
<tr><td>17</td><td colspan="3">Beam Load</td><td>Destruction value should be exceed
Chip Length ≤ 2.5mm
a) Chip Thickness > 0.5mm : 20N
b) Chip Thickness ≤ 0.5mm : 8N
Chip Length ≥ 3.2mm
a) Chip Thickness ≥ 1.25mm : 54.5N
b) Chip Thickness < 1.25mm : 15N</td><td>Beam speed
Chip Length ≤ 2.5mm, 0.50±0.05mm / sec.
Chip Length ≥ 3.5mm, 2.50±0.25mm / sec.</td></tr>
<tr><td rowspan="2">18</td><td rowspan="2">Capaci-tance Tempera-ture Character-istics</td><td rowspan="2">Capacitance Change</td><td>Class I</td><td>0±30ppm / ℃</td><td rowspan="2">Capacitance shall be measured by the steps shown in the following table.
<table>
<tr><th>Step</th><th>Temperature(℃)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>Min. operating temp.±2</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>Max. operating temp.±2</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table>
■ Class I
Temperature Coefficient shall be calculated from the formula as below
Temp. Coefficient = $\frac{C2 - C1}{C1 \times \triangle T} \times 10^6$[ppm /℃]
C1 : Capacitance at step 3 C2 : Capacitance at 125℃ △T : 125℃ - 25℃ = 100℃

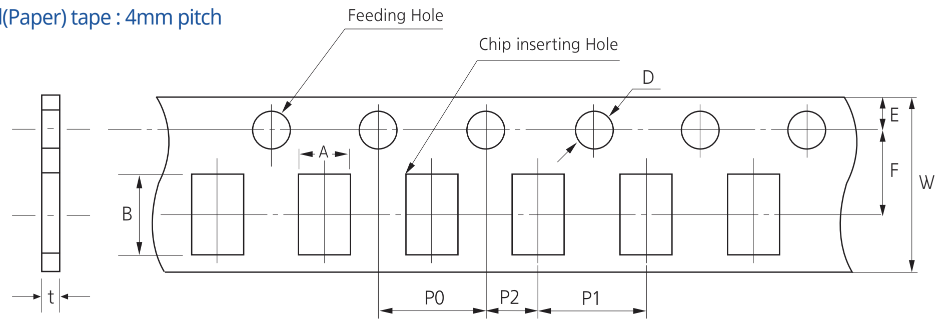
■ Class II
Capacitance change shall be calculated from the formula as below
$\triangle C = \frac{C2 - C1}{C1} \times 100(\%)$
C1 : Capacitance at step 3 C2 : Capacitance at step)2 or step 4</td></tr>
<tr><td>Class II</td><td>Within±15%</td></tr>
</table>

※ *1) : Indicates typical specification. Please refer to individual specifications.
If you want more detaiedl imformation, Please Visit Samsung Electro - mechanics website (www.semlcr.com)

Packaging Specifications

Tape Size

Cardboard(Paper) tape : 4mm pitch

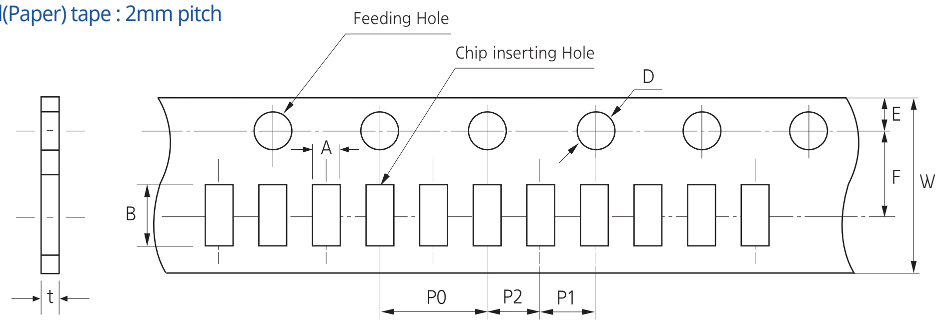


[unit : mm]

<table>
<tr><th>Size Inch(mm)</th><th>A</th><th>B</th><th>W</th><th>F</th><th>E</th><th>P1</th><th>P2</th><th>P0</th><th>D</th><th>t</th></tr>
<tr><td>0603 (1608)</td><td>1.00 ±0.10</td><td>1.90 ±0.10</td><td rowspan="3">8.00 ±0.30</td><td rowspan="3">3.50 ±0.05</td><td rowspan="3">1.75 ±0.10</td><td rowspan="3">4.00 ±0.10</td><td rowspan="3">2.00 ±0.05</td><td rowspan="3">4.00 ±0.10</td><td rowspan="3">Φ1.50 +0.10/-0</td><td rowspan="3">1.10 Below</td></tr>
<tr><td>0805 (2012)</td><td>1.55 ±0.10</td><td>2.30 ±0.10</td></tr>
<tr><td>1206 (3216)</td><td>2.05 ±0.10</td><td>3.60 ±0.10</td></tr>
</table>

※ The A, B in the table above are based on normal dimensions. The data may be changed with the special size tolerances.

Cardboard(Paper) tape : 2mm pitch



[unit : mm]

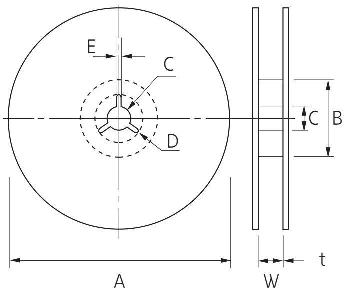
<table>
<tr><th>Size Inch(mm)</th><th>A</th><th>B</th><th>W</th><th>F</th><th>E</th><th>P1</th><th>P2</th><th>P0</th><th>D</th><th>t</th></tr>
<tr><td>1005 (0402)</td><td>0.25 ±0.02</td><td>0.46 ±0.02</td><td rowspan="4">8.00 ±0.30</td><td rowspan="4">3.50 ±0.05</td><td rowspan="4">1.75 ±0.10</td><td rowspan="4">2.00 ±0.05</td><td rowspan="4">2.00 ±0.05</td><td rowspan="4">4.00 ±0.10</td><td rowspan="4">Φ1.50 0.10 /-0.03</td><td>0.25 ±0.02</td></tr>
<tr><td>0201 (0603)</td><td>0.38 ±0.03</td><td>0.68 ±0.03</td><td>0.35 ±0.03</td></tr>
<tr><td>0402 (1005)</td><td>0.62 ±0.05</td><td>1.12 ±0.05</td><td>0.60 ±0.05</td></tr>
<tr><td>0204 (0510)</td><td>0.62 0.05 /-0.10</td><td>1.12 0.05 /-0.10</td><td>0.37 ±0.03</td></tr>
</table>

※ The A, B in the table above are based on normal dimensions. The data may be changed with the special size tolerances.

Packaging Specifications

Tape Size

Reel Size



[unit : mm]

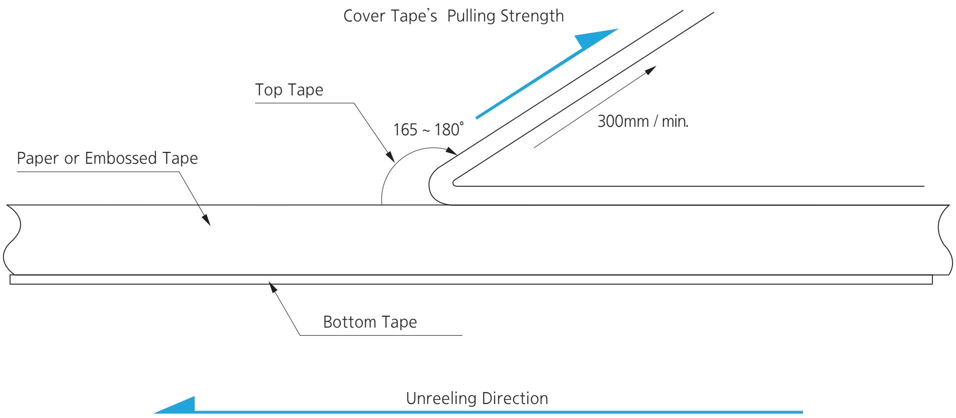
Symbol	Tape Width	A	B	C	D	E	W	t
7"Reel	4mm	Φ178±2.0	MINΦ50	Φ13±0.5	21±0.8	2.0±0.5	5±0.5	1.2±0.2
	8mm	Φ178±2.0	MINΦ50	Φ13±0.5	21±0.8	2.0±0.5	10±1.5	0.9±0.2
	12mm	Φ178±2.0	MINΦ50	Φ13±0.5	21±0.8	2.0±0.5	13±0.5	1.2±0.2
10"Reel	8mm	Φ258±2.0	MINΦ70	Φ13±0.5	21±0.8	2.0±0.5	10±1.5	1.8±0.2
13"Reel	8mm	Φ330±2.0	MINΦ70	Φ13±0.5	21±0.8	2.0±0.5	10±1.5	1.8±0.2
	12mm	Φ330±2.0	MINΦ70	Φ13±0.5	21±0.8	2.0±0.5	13±0.5	2.2±0.2

Cover tape peel-off force

Peel-off force

10 g.f ≤ peel-off force ≤ 70 g.f

Measurement Method

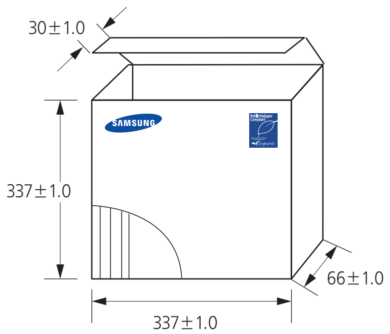


- Taping Packaging design : Packaging design follows IEC 60286-3 standard. (IEC 60286-3 Packaging of components for automatic handling - parts 3)
* If the static electricity of SMT process causes any problems, please contact us.

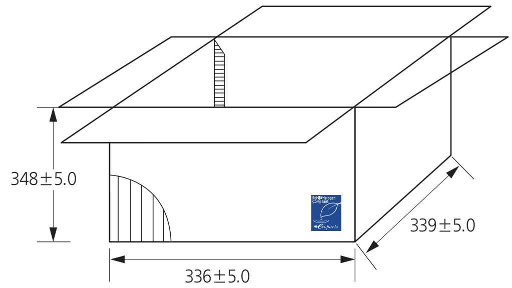
Packaging Specifications

13" Box packaging

• Inner Box (13" × 4 REEL)



• Outer Box (13" × 20 REEL)



Chip Weight

Size(L/W) Inch(mm)	Size(T) (mm)	Temp.	Weight (mg/pc)
1005 (0402)	0.20	C0G	0.082
	0.20	X7R	0.083
	0.20	X5R	0.093
0402 (1005)	0.50	C0G	1.182
	0.50	X7R	1.559
	0.50	X5R	1.560
0805 (2012)	0.65	C0G	7.192
	1.25	X7R	16.523
	1.25	X5R	16.408
1210 (3225)	2.50	X7R	116.197
	2.50	X5R	121.253
1812 (4532)	1.25	X7R	96.697

Size(L/W) Inch(mm)	Size(T) (mm)	Temp.	Weight (mg/pc)
0201 (0603)	0.30	C0G	0.233
	0.30	X7R	0.285
	0.30	X5R	0.317
0603 (1608)	0.80	C0G	4.615
	0.80	X7R	5.522
	0.80	X5R	5.932
1206 (3216)	1.25	C0G	28.086
	1.60	X7R	54.050
	1.60	X5R	45.600
1808 (4520)	1.25	C0G	47.382
	1.25	X7R	63.136
2220 (5750)	1.60	X7R	260.897

The weight of product is typical value per size, for more details, please contact us.

3. Insulation Resistance

Ceramic dielectric has a low leakage current with DC voltage due to the high insulating properties.
Insulation resistance is defined as the ratio of a leakage current to DC voltage.

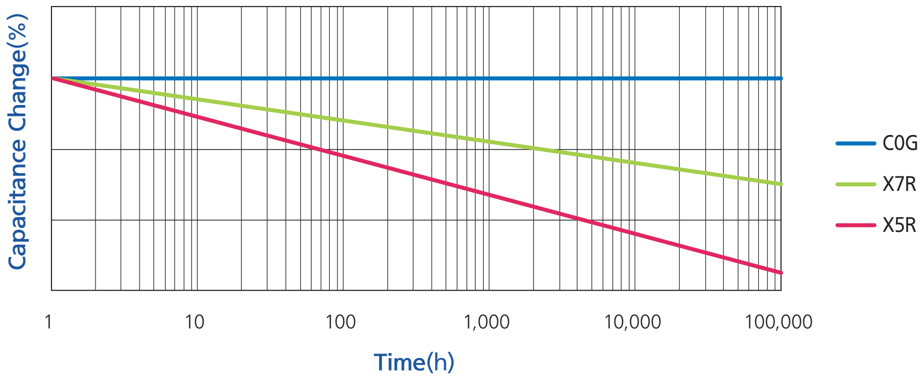
3-1. When applying DC voltage to MLCC, a charging current and a leakage current flow together at the initial stage of measurement.
While the charging current decreases, and insulation resistance (IR) in MLCC is saturated by time.
Therefore, insulation resistance shall be measured 1 minute after applying the rated voltage.

4. Capacitance Aging

The aging characteristic is that the high dielectric (Class II) MLCC decreases capacitance value over time. It is also necessary to consider the aging characteristic with voltage and temperature characteristics when Class II MLCC is used in circuitry.

4-1. In general, aging causes capacitance to decrease linearly with the log of time as shown in the following graph. Please check with SEMCO for more details, since the value may vary between different models.

4-2. After heat treatment (150°C, 1hour), the capacitance decreased by aging is recovered, so aging should be considered again from the time of heat treatment.

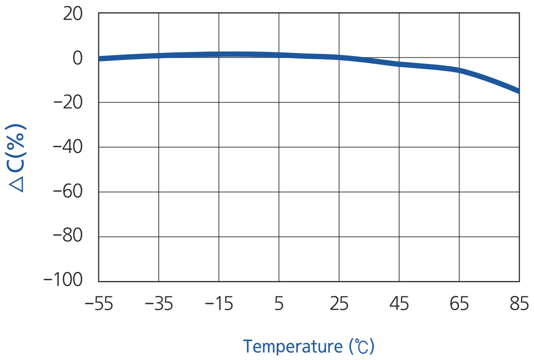


[Example of Capacitance Aging]
* Sample : C0G, X7R, X5R

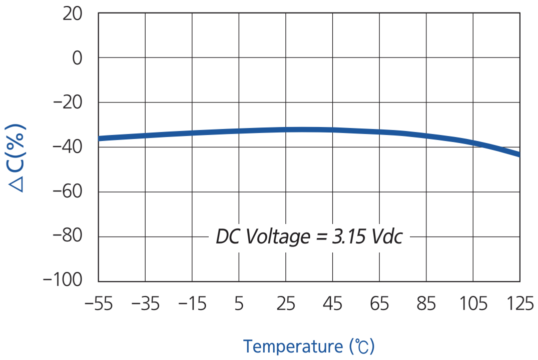
5. Temperature Characteristics of Capacitance (TCC)

Please consider temperature characteristics of capacitance since the electrical characteristics such as capacitance changes which is caused by a change in ceramic dielectric constant by temperature.

5-1. It is necessary to check the values specified in section "C. Reliability test Condition–Temperature Characteristics" for the temperature and capacitance change range of MLCC.



[Example of Temperature Characteristics (X5R)]
* Sample : 10uF, Rated voltage 6.3V

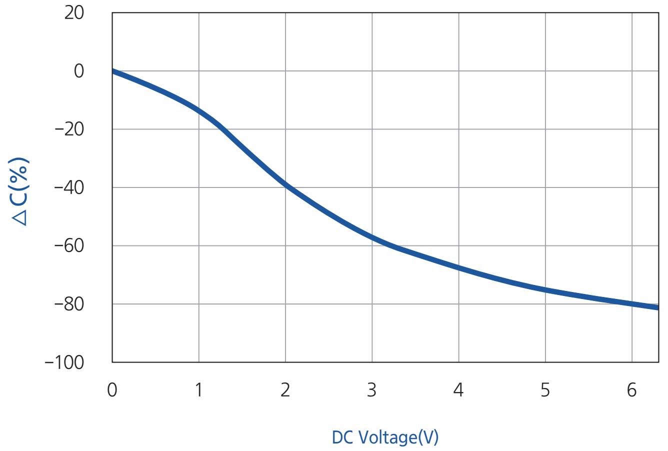


[Example of Bias TCC]
* Sample : 10uF, Rated voltage 6.3V

7. DC & AC Voltage Characteristics

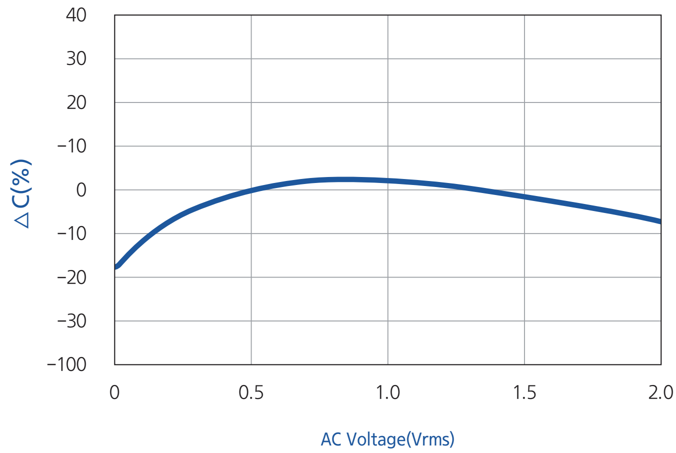
It is required to consider voltage characteristics in the circuit since the capacitance value of high dielectric constant MLCC(Class II) is changed by applied DC & AC voltage.

7-1. Please ensure the capacitance change is within the allowed operating range of a system. In particular, when high dielectric constant type MLCC (Class II) is used in circuit with narrow allowed capacitance tolerance, a system should be designed with considering DC voltage, temperature characteristics and aging characteristics of MLCC.



[Example of DC Bias characteristics]
* Sample : X5R 10uF, Rated voltage 6.3V

7-2. It is necessary to consider the AC voltage characteristics of MLCC and the AC voltage of a system, since the capacitance value of high dielectric constant type MLCC (Class II) varies with the applied AC voltage.



[Example of AC voltage characteristics]
* Sample : X5R 10uF, Rated voltage 6.3V

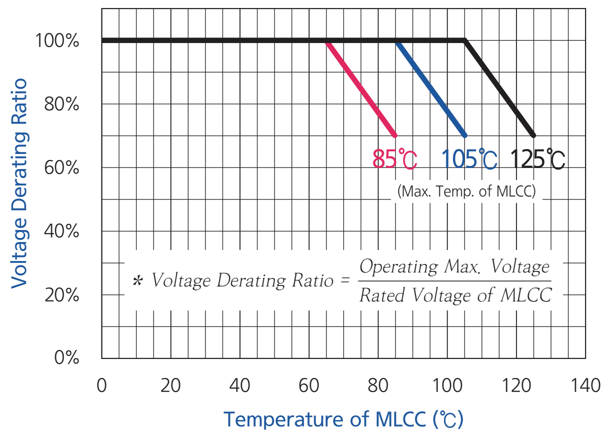
Electrical & Mechanical Caution

1. Derating

MLCC with the test voltage at 100% of the rated voltage in the high temperature resistance test are labeled as "derated MLCC." For this type of MLCC, the voltage and temperature should be derated as shown in the following graph for the equivalent life time of a normal MLCC with the test voltage at 150% of the rated voltage in the high temperature resistance test.

1-1. The derated MLCC should be applied with the derating voltage and temperature as shown in the following graph.

1-2. The "Temperature of MLCC" in the x-axis of the graph below indicates the surface temperature of MLCC including self-heating effect. The "Voltage Derating Ratio" in the y-axis of the graph below gives the maximum operating voltage of MLCC with reference to the maximum voltage (Vmax) as defined in section "3-2. Applied Voltage."



[Example of derating graph for derated MLCC]
* Vmax ≤ Derated Voltage
* Only the Derating marked models

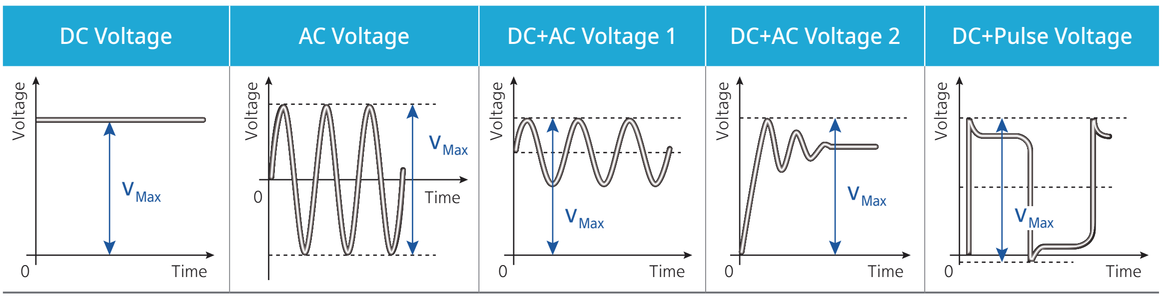
2. Applied Voltage

The actual applied voltage on MLCC should not exceed the rated voltage set in the specifications.

2-1. Cautions by types of voltage applied to MLCC

- For DC voltage or DC+AC voltage, DC voltage or the maximum value of DC + AC voltage should not exceed the rated voltage of MLCC.
- For AC voltage or pulse voltage, the peak-to-peak value of AC voltage or pulse voltage should not exceed the rated voltage of MLCC.
- Abnormal voltage such as surge voltage, static electricity should not exceed the rated voltage of MLCC.

Types of Voltage Applied to the Capacitor

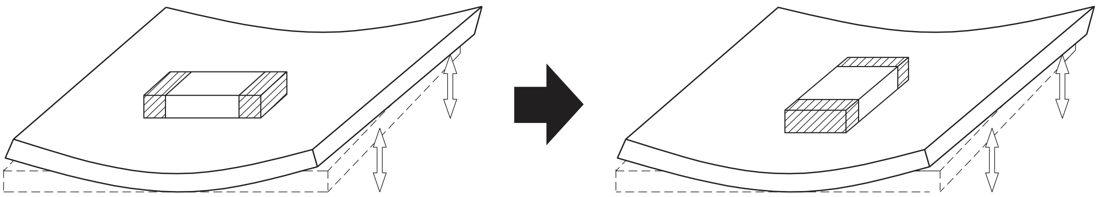


Process of Mounting and Soldering

1. Mounting

1-1. Mounting position

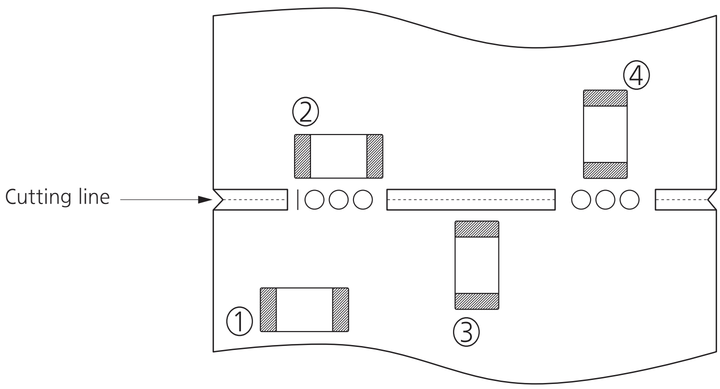
It is recommended to locate the major axis of MLCC in parallel to the direction in which the stress is applied.



Not recommended　　　　Recommended

1-2. Cautions during mounting near the cutout

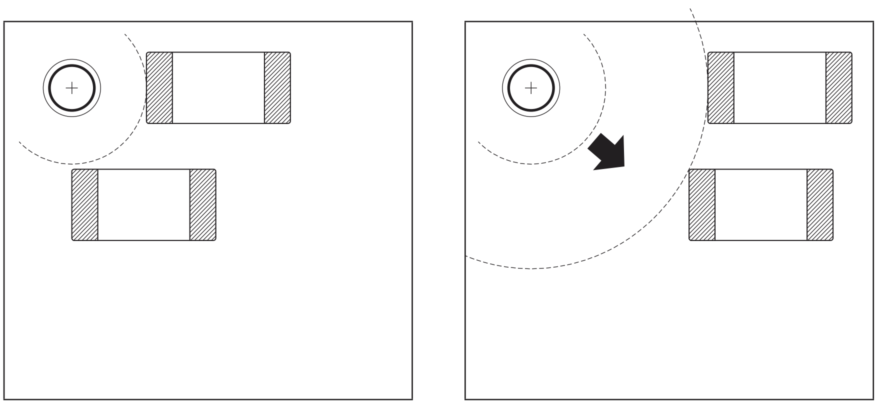
Please take the following measures to effectively reduce the stress generated from the cutting of PCB. Select the mounting location shown below, since the mechanical stress is affected by a location and a direction of MLCC mounted near the cutting line.



※ Relate mechanical stress
② > ①
③ > ①
④ > ①

1-3. Cautions during mounting near screw

If MLCC is mounted near a screw hole, the board deflection may be occurred by screw torque.
Mount MLCC as far from the screw holes as possible.



Not recommended　　　　Recommended

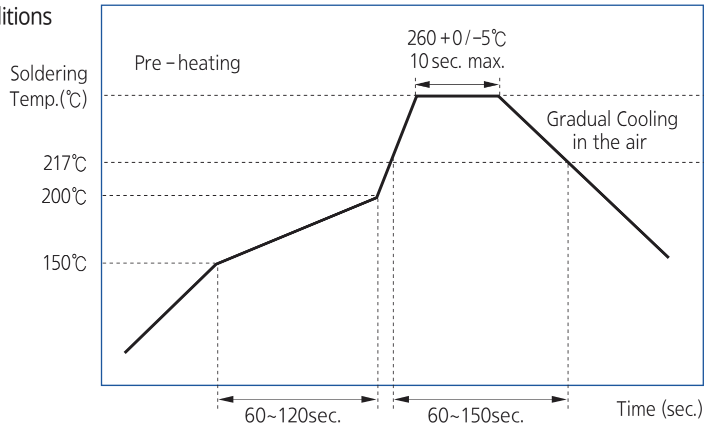
4. Reflow soldering

MLCC is in a direct contact with the dissolved solder during soldering, which may be exposed to potential mechanical stress caused by the sudden temperature change.
Therefore, MLCC may be contaminated by the location movement and flux.
For the reason, the mounting process must be closely monitored.

Method		Classification
Reflow soldering	Overall heating	Infrared rays Hot plate VPS(Vapor phase)
	Local heating	Air heater Laser Light beam

4-1. Reflow Profile

· Reflow Soldering Conditions



Use caution not to exceed the peak temperature (260°C) and time (30sec) as shown.
Pre-heating is necessary for all constituents including the PCB to prevent the mechanical damages on MLCC. The temperature difference between the PCB and the component surface must be kept to the minimum.

As for reflow soldering, it is recommended to keep the number of reflow soldering to less than three times. Please check with us when the number of reflow soldering needs to exceed three times. Care must be exercised especially for the ultra-small size, thin film and high capacitance MLCC as they can be affected by thermal stress more easily.

4-2. Reflow temperature

The following quality problem may occur when MLCC is mounted with a lower temperature than the reflow temperature recommended by a solder manufacturer. The specified peak temperature must be maintained after taking into consideration the factors such as the placement of peripheral constituent and the reflow temperature.

- Drop in solder wettability
- Solder voids
- Potential occurrence of whisker
- Drop in adhesive strength
- Drop in self-alignment properties
- Potential occurrence of tombstones

4-3. Cooling

Natural cooling with air is recommended.

6. Soldering Iron

Manual soldering can pose a great risk on creating thermal cracks in MLCC. The high temperature soldering iron tip may come into a direct contact with the ceramic body of MLCC due to the carelessness of an operator. 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.

6-1. How to use a soldering Iron

- In order to minimize damages on MLCC, preheating MLCC and PCB is necessary.
  A hot plate and a hot air type preheater should be used for preheating
- Do not cool down MLCC and PCB rapidly after soldering.
- Keep the contact time between the outer termination of MLCC and the soldering iron as short as possible. Long soldering time may cause problems such as adhesion deterioration by the leaching phenomenon of the outer termination.

Variation of Temp.	Soldering Temp.(℃)	Pre-heating Time(sec)	Soldering Time(sec)	Cooling Time(sec)
ΔT ≤ 130	300±10℃ max	≥60	≤4	-

* Control Δ T in the solder iron and preheating temperature.

Condition of Iron facilities		
Wattage	Tip diameter	Soldering time
20W max	3㎜ max	4sec max

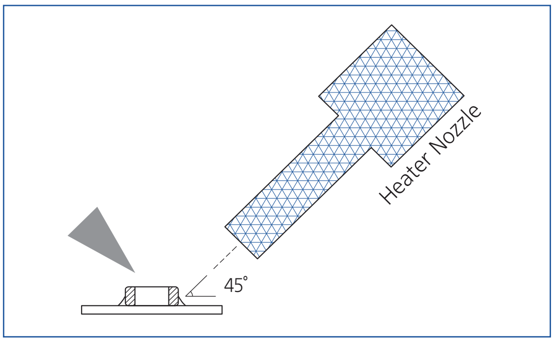
* Caution - Iron tip should not contact with ceramic body directly Lead-free solder: Sn-3.0Ag-0.5CU

6-2. How to use a spot heater

Compared to local heating using a solder iron, heat by a spot heater heats the overall MLCC and the PCB, which is likely to lessen the thermal shocks.
For a high density PCB, a spot heater can prevent the problem to connect between a solder iron and MLCC directly.

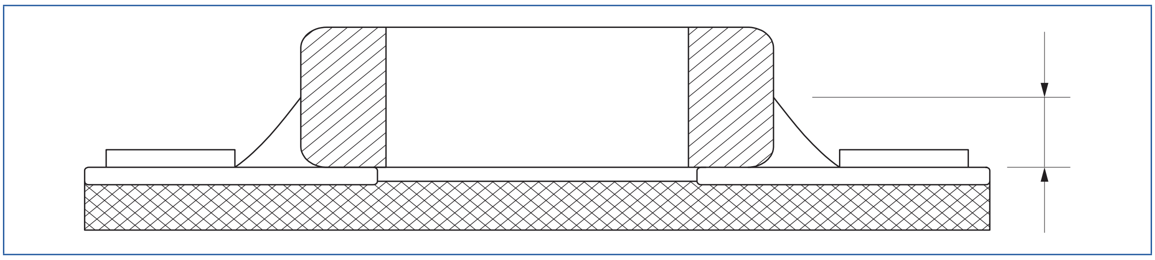
- If the distance from the air nozzle outlet to MLCC is too close, MLCC may be cracked due to the thermal stress. Follow the conditions set in the table below to prevent this problem.
- The spot heater application angle as shown in the figure is recommended to create a suitable solder fillet shape

Distance	5㎜ ≤
Hot Air Application angle	45℃
Hot Air Temperature Nozzle Outlet	400℃ ≥
Application Time	10s >



6-3. Cautions for re-work

- Too much solder amount will increase the risk of PCB bending or cause other damages.
- Too little solder amount will result in MLCC breaking loose from the PCB due to the inadequate adhesive strength.
- Check if the solder has been applied properly and ensure the solder fillet has a proper shape.



* Soldering wire below 0.5mm is required for soldering.

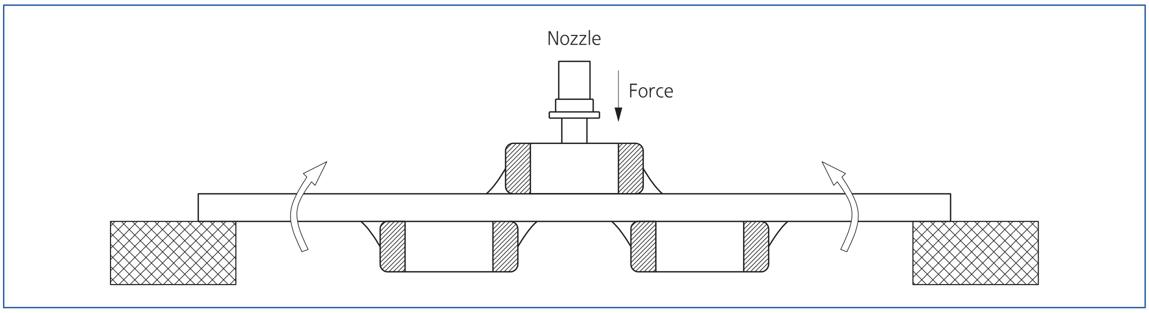
10. Assembly Handling

10-1. Cautions for PCB handling

Hold the edges of the board mounted with MLCC with both hands since holding with one handmay bend the board.
Do not use dropped boards, which may degrade the quality of MLCC.

10-2. Mounting other components

Pay attention to the following conditions when mounting other components on the back side of The board after MLCC has been mounted on the front side.
When the suction nozzle is placed too close to the board, board deflection stress may be applied to MLCC on the back side, resulting in cracks in MLCC.
Check if proper value is set on each chip mounter for a suction location, a mounting gap and a suction gap by the thickness of components.

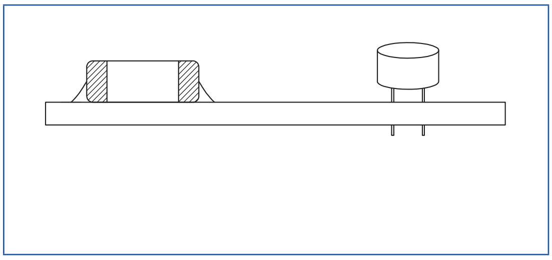


10-3. Board mounting components with leads

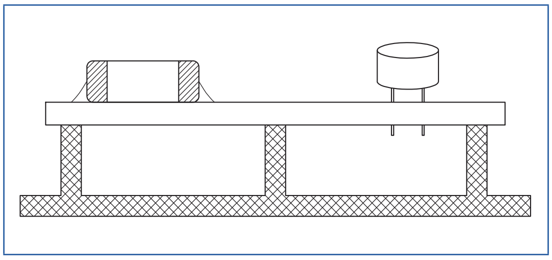
If the board is bent when inserting components (transformer, IC, etc.) into it, MLCC or solder joint may be cracked.

Pay attention to the following:

- Reduce the stress on the board during insertion by increasing the size of the lead insertion hole.
- Insert components with leads into the board after fixing the board with support pins or a dedicated jig.
- Support the bottom side of the board to avoid bending the board.
- Check the status of the height of each support pin regularly when the support pins are used.



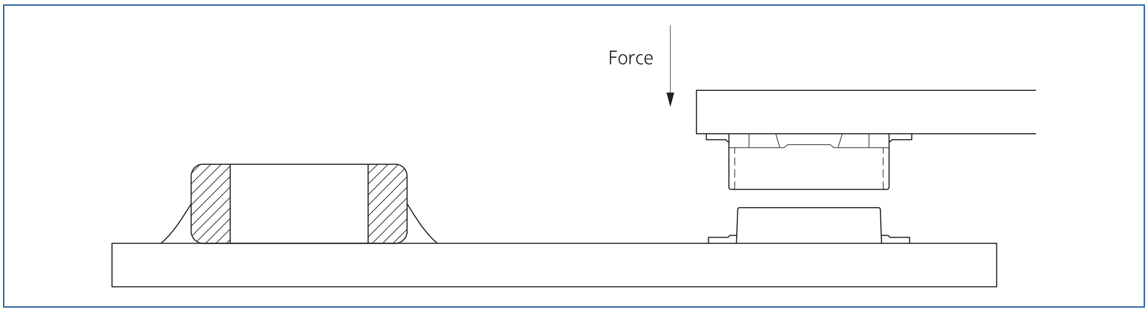
Not recommended



Recommended

10-4. Socket and / or connector attach / detach

Since the insertion or removal from sockets and connectors may cause the board to bent, make sure that MLCC mounted on the board should not be damaged in this process.



13. Coating

13-1. Crack caused by Coating

A crack may be caused in the MLCC due to amount of the resin and stress of thermal contraction of the resin during coating process.
During the coating process, the amount of resin and the stress of thermal contraction of the resin may cause cracks in MLCC.
The difference of thermal expansion coefficient between the coating, or a molding resin may cause destruction, deterioration of insulation resistance or dielectric breakdown of MLCC such as cracks or detachment, etc.

13-2. Recommended Coating material

- A thermal expansion coefficient should be as close to that of MLCC as possible.
- A silicone resin can be used as an under-coating to buffer the stress.
- The resin should have a minimum curing contraction rate.
- The resin should have a minimum sensitivity (ex. Epoxy resin).
- The insulation resistance of MLCC can be deteriorated if a high hygroscopic property resin is used in a high humidity condition.
- Do not use strong acid substances due to the fact that coating materials inducing a family of halogen substances and organic acid may corrode MLCC.

Design

1. Circuit design

When the board is dropped or bent, MLCC mounted on the board may be short-circuited by the drop in insulation resistance. Therefore, it is required to install safety equipment such as a fuse to prevent additional accidents when MLCC is short-circuited, otherwise, electric short and fire may occur. This product is not a safety guaranteed product..

2. PCB Design

2-1. Unlike lead type components, SMD type components that are designed to be mounted directly on the board are fragile to the stress. In addition, they are more sensitive to mechanical and thermal stress than lead type components.

2-2. MLCC crack by PCB material type
A great difference of the thermal expansion coefficient between PCB and MLCC causes thermal expansion and contraction, resulting in cracks in MLCC. Even though MLCC is mounted on a board with a fluorine resin or on a single-layered glass epoxy, cracks in MLCC may occur.

3. Design system evaluation

3-1. Evaluate the actual design with MLCC to make sure there is no functional issue or violation of specifications of the finished goods.

3-2. Please note that the capacitance may differ based on the operating condition of the actual system since Class 2 MLCC capacitance varies with applied voltage and temperature.

3-3. Surge resistance must be evaluated since the excessive surge caused by the inductance of the actual system may apply to MLCC.

3-4. Note the actual MLCC size and the termination shape.

Others

1. Storage environment

1-1. Recommendation for temperature/humidity

Even taping and packaging materials are designed to endure a long-term storage, they should be stored with a temperature of 0~40°C and an RH of 0~70% otherwise, too high temperatures or humidity may deteriorate the quality of the product rapidly.

As oxidization is accelerated when relative humidity is above 70%RH, the lower the humidity is, the better the solderability is. As the temperature difference may cause dew condensation during the storage of the product, it is a must to maintain a temperature control environment

1-2. Shelf Life

An allowable storage period should be within 6 months from the outgoing date of delivery in consideration of solderability. As for products in storage over 6 months, please check solderability before use.

2. Caution for corrosive environment

As corrosive gases may deteriorate the solderability of MLCC outer termination, it is a must to store MLCC in an environment without gases. MLCC that is exposed to corrosive gases may cause its quality issues due to the corrosion of plating layers and the penetration of moisture.

3. Equipment in operation

3-1. Do not touch MLCC directly with bare hands to prevent an electric shock or damage.

3-2. The termination of MLCC shall not be contacted with a conductive object (short –circuit).
Do not expose MLCC to conductive liquid containing acidic or alkaline material.

3-3. Do not use the equipment in the following conditions.
(1) Exposure to water or oil
(2) Exposure to direct sunlight
(3) Exposure to Ozone or ultra-violet radiation.
(4) Exposure to corrosive gas (e.g. hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas)
(5) Exposure to vibration or mechanical shock exceeding specified limit
(6) Exposure to high humidity

3-4. If the equipment starts generating any smoke, fire or smell, immediately switch it off or unplug from the power source.
If the equipment is not switched off or unplugged, serious damage may occur due to the continuous power supply. Please be careful with the high temperature in this condition.

4. Waste treatment

In case of scrapping MLCC, it is incinerated or buried by a licensed industrial waste company.
When scrapping MLCC, it is recommended to incinerate or bury the scrappage by a licensed industrial waste company.

5. Operating temperature

The operating temperature limit is determined by the specification of each models.

5-1. Do not use MLCC over the maximum operating temperature.
Pay attention to equipment's temperature distribution and the seasonal fluctuation of ambient temperature.

5-2. The surface temperature of MLCC cannot exceed the maximum operating temperature including self-heating effects.

Certifications

ISO9001 & IATF 16949

bsi.

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - IATF 16949:2016

ISO 14001

BUREAU VERITAS Certification

SAMSUNG ELECTRO-MECHANICS CO., LTD.

ISO 14001:2015

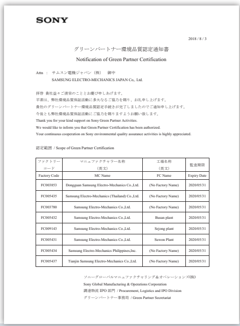
OHSAS18001

BUREAU VERITAS Certification

SAMSUNG ELECTRO-MECHANICS CO., LTD.

OHSAS 18001:2007

Sony Green Partner



SONY

Notification of Green Partner Certification

QC 080000 IECQ HSPM

IECQ Certificate of Conformity

Hazardous Substance Process Management

Quality System Certification status for each factory site

Certification	Busan (Korea)	Tianjin (China)
IATF 16949	BSI IATF16949 91430-001	BSI IATF16949 91430-012
Date Validity	2019-04-04 ~ 2021-06-18	2019-04-04 ~ 2021-09-03
ISO 14001	KE191620	098_18_E1_012_R1_L
Date Validity	2019-06-10 ~ 2022-06-24	2018-04-15 ~ 2021-04-14
OHSAS 18001		098_18_S1_002_R1_L
Date Validity		2018-04-15 ~ 2021-03-12
QC 080000	IECQ-H_ULTW_10.0018	IECQ-H_ULTW_10.0021
Date Validity	2019-07-17 ~ 2022-07-19	2019-07-25 ~ 2022-07-26
ISO5001	18213-1	098_18_En1_021_R2_L
Date Validity	2019-05-17 ~ 2021-08-3019	2018-12-26 ~ 2021-08-30
ISO 45001	KS19017	TBD('20.May)
Date Validity	2019-06-10 ~ 2022-06-09	

Disclaimer & Limitation of Use and Application

The products listed in this Specification sheet are NOT designed and manufactured for any use and applications set forth below.

Please note that any misuse of the products deviating from products specifications or information provided in this Spec sheet may cause serious property damages or personal injury.
We will NOT be liable for any damages resulting from any misuse of the products, specifically including using the products for high reliability applications as listed below.

If you have any questions regarding this 'Limitation of Use and Application', you should first contact our sales personnel or application engineers.

① Aerospace/Aviation equipment
② Medical equipment
③ Military equipment
④ Disaster prevention/crime prevention equipment
⑤ Power plant control equipment
⑥ Atomic energy-related equipment
⑦ Undersea equipment
⑧ Traffic signal equipment
⑨ Data-processing equipment
⑩ Electric heating apparatus, burning equipment
⑪ Safety equipment
⑫ Any other applications with the same as or similar complexity or reliability to the applications

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Passive components manufacturing sites

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Gangseo-gu, Busan 46754
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