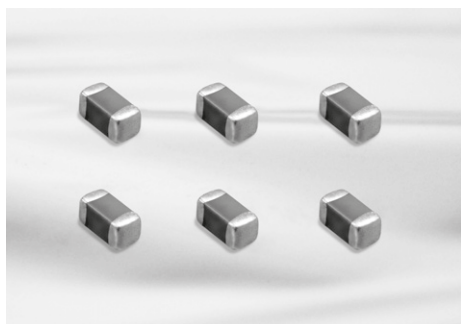


Premium Capacitors for Automotive Applications



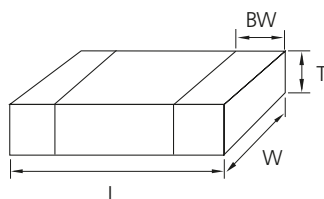
Feature

- Automotive products are manufactured in state of the art facilities recommended for registration to ISO/TS 16949:2002.
- Automotive products meet AEC-Q-200 requirements.
- Automotive products are RoHS compliant.
- Samsung terminations are suitable for all flow and reflow soldering systems. (10/21/31 size type only)
- Automotive products meet JEDEC-020-D requirements.
- COG dielectric components contain BME and copper terminations with a Ni/Sn plated overcoat.
- X7R dielectric components have BME and soft terminations with a Ni/Sn plated overcoat.

Application

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

Structure and Dimensions



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	0.60(± 0.10)	0.5+0.2/-0.3
				0.85(± 0.10)	
				1.25(± 0.10)	
		2.00±0.15	1.25±0.15	1.25(± 0.15)	
31	1206	3.20±0.20	1.60±0.20	0.85(± 0.15)	0.50±0.30
				1.15(± 0.10)	
				1.60(± 0.20)	
32	1210	3.20±0.30	2.50±0.20	2.00(± 0.20)	0.60±0.30
				2.50(± 0.20)	

Automotive Capacitors Table (C0G, X7R)

TC	Size (mm)	Thickness (mm)	Vr	Capacitance (pF)			Capacitance (nF)								
				100	220	470	1	2.2	4.7	10	22	47	100		
COG	0402(1005)	0.50	50	[Bar]											
			100	[Bar]											
	0603(1608)	0.80	50	[Bar]											
			100	[Bar]			271								
	0805(2012)	0.60 0.85 1.25	50	[Bar]											
			100	[Bar]											
TC	Size (mm)	Thickness (mm)	Vr	Capacitance (nF)					Capacitance (μF)						
				10	22	47	100	220	470	1	2.2	4.7	10	22	
X7R	0402(1005)	0.50	10	[Bar]											
			16	[Bar]											
			25	[Bar]											
			50	[Bar]											
	0603(1608)	0.80	10	[Bar]											
			16	[Bar]											
			25	[Bar]											
			50	[Bar]											
			100	[Bar]											
	0805(2012)	1.25	16	10	[Bar]										
				16	[Bar]										
				25	[Bar]										
		0.85	25	10	[Bar]										
				16	[Bar]										
				25	[Bar]										
		0.60	50	10	[Bar]										
				16	[Bar]										
				25	[Bar]										
		1.25	100	10	[Bar]										
				16	[Bar]										
				25	[Bar]										
	1206(3216)	1.60	16	10	[Bar]										
				16	[Bar]										
				25	[Bar]										
1.15		25	10	[Bar]											
			16	[Bar]											
			25	[Bar]											
0.85		50	10	[Bar]											
			16	[Bar]											
3225(1210)	2.70	16	10	[Bar]											

- Part Numbering System
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- Low ESL Capacitors
- Reliability Test Condition
- Premium Capacitors for Automotive Applications
- Packaging Specification
- Application Manual for Surface Mounting



Product Lineup (Automotive Capacitors-COG)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
1	CL05C4R7CB51PN □	1.00×0.50	4.7pF	50	±0.25pF	0.55
2	CL05C4R7CC51PN □		4.7pF	100	±0.25pF	0.55
3	CL05C6R8DB51PN □		6.8pF	50	±0.5pF	0.55
4	CL05C6R8DC51PN □		6.8pF	100	±0.5pF	0.55
5	CL05C100JB51PN □		10pF	50	±5%	0.55
6	CL05C100JC51PN □		10pF	100	±5%	0.55
7	CL05C120JB51PN □		12pF	50	±5%	0.55
8	CL05C120JC51PN □		12pF	100	±5%	0.55
9	CL05C150JB51PN □		15pF	50	±5%	0.55
10	CL05C150JC51PN □		15pF	100	±5%	0.55
11	CL05C180JB51PN □		18pF	50	±5%	0.55
12	CL05C180JC51PN □		18pF	100	±5%	0.55
13	CL05C220JB51PN □		22pF	50	±5%	0.55
14	CL05C220JC51PN □		22pF	100	±5%	0.55
15	CL05C270JB51PN □		27pF	50	±5%	0.55
16	CL05C270JC51PN □		27pF	100	±5%	0.55
17	CL05C330JB51PN □		33pF	50	±5%	0.55
18	CL05C330JC51PN □		33pF	100	±5%	0.55
19	CL05C390JB51PN □		39pF	50	±5%	0.55
20	CL05C390JC51PN □		39pF	100	±5%	0.55
21	CL05C470JB51PN □		47pF	50	±5%	0.55
22	CL05C470JC51PN □		47pF	100	±5%	0.55
23	CL05C560JB51PN □		56pF	50	±5%	0.55
24	CL05C560JC51PN □		56pF	100	±5%	0.55
25	CL05C680JB51PN □		68pF	50	±5%	0.55
26	CL05C680JC51PN □		68pF	100	±5%	0.55
27	CL05C820JB51PN □		82pF	50	±5%	0.55
28	CL05C820JC51PN □		82pF	100	±5%	0.55
29	CL05C101JB51PN □		100pF	50	±5%	0.55
30	CL05C101JC51PN □		100pF	100	±5%	0.55
31	CL05C121JB51PN □		120pF	50	±5%	0.55
32	CL05C151JB51PN □		150pF	50	±5%	0.55
33	CL05C221JB51PN □		220pF	50	±5%	0.55
1	CL10C4R7CB81PN □	1.60×0.80	4.7pF	50	±0.25pF	0.90
2	CL10C4R7CC81PN □		4.7pF	100	±0.25pF	0.90
3	CL10C6R8DB81PN □		6.8pF	50	±0.5pF	0.90
4	CL10C6R8DC81PN □		6.8pF	100	±0.5pF	0.90
5	CL10C100JB81PN □		10pF	50	±5%	0.90
6	CL10C100JC81PN □		10pF	100	±5%	0.90
7	CL10C120JB81PN □		12pF	50	±5%	0.90
8	CL10C120JC81PN □		12pF	100	±5%	0.90
9	CL10C150JB81PN □		15pF	50	±5%	0.90
10	CL10C150JC81PN □		15pF	100	±5%	0.90
11	CL10C180JB81PN □		18pF	50	±5%	0.90
12	CL10C180JC81PN □		18pF	100	±5%	0.90
13	CL10C220JB81PN □		22pF	50	±5%	0.90
14	CL10C220JC81PN □		22pF	100	±5%	0.90
15	CL10C270JB81PN □		27pF	50	±5%	0.90
16	CL10C270JC81PN □		27pF	100	±5%	0.90
17	CL10C330JB81PN □		33pF	50	±5%	0.90

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Product Lineup (Automotive Capacitors-COG)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
18	CL10C330JC81PN □	1.60×0.80	33pF	100	±5%	0.90
19	CL10C390JB81PN □		39pF	50	±5%	0.90
20	CL10C390JC81PN □		39pF	100	±5%	0.90
21	CL10C470JB81PN □		47pF	50	±5%	0.90
22	CL10C470JC81PN □		47pF	100	±5%	0.90
23	CL10C560JB81PN □		56pF	50	±5%	0.90
24	CL10C560JC81PN □		56pF	100	±5%	0.90
25	CL10C680JB81PN □		68pF	50	±5%	0.90
26	CL10C680JC81PN □		68pF	100	±5%	0.90
27	CL10C820JB81PN □		82pF	50	±5%	0.90
28	CL10C820JC81PN □		82pF	100	±5%	0.90
29	CL10C101JB81PN □		100pF	50	±5%	0.90
30	CL10C101JC81PN □		100pF	100	±5%	0.90
31	CL10C121JB81PN □		120pF	50	±5%	0.90
32	CL10C151JB81PN □		150pF	50	±5%	0.90
33	CL10C221JB81PN □		220pF	50	±5%	0.90
34	CL10C221JC81PN □		220pF	100	±5%	0.90
35	CL10C271JB81PN □		270pF	50	±5%	0.90
36	CL10C331JB81PN □		330pF	50	±5%	0.90
37	CL10C391JB81PN □		390pF	50	±5%	0.90
38	CL10C471JB81PN □		470pF	50	±5%	0.90
39	CL10C561JB81PN □		560pF	50	±5%	0.90
40	CL10C681JB81PN □		680pF	50	±5%	0.90
41	CL10C821JB81PN □		820pF	50	±5%	0.90
42	CL10C102JB81PN □	1.0nF	50	±5%	0.90	
1	CL21C100JB61PN □	2.00×1.25	10pF	50	±5%	0.70
2	CL21C100JC61PN □		10pF	100	±5%	0.70
3	CL21C120JB61PN □		12pF	50	±5%	0.70
4	CL21C120JC61PN □		12pF	100	±5%	0.70
5	CL21C150JB61PN □		15pF	50	±5%	0.70
6	CL21C150JC61PN □		15pF	100	±5%	0.70
7	CL21C180JB61PN □		18pF	50	±5%	0.70
8	CL21C180JC61PN □		18pF	100	±5%	0.70
9	CL21C220JB61PN □		22pF	50	±5%	0.70
10	CL21C220JC61PN □		22pF	100	±5%	0.70
11	CL21C270JC61PN □		27pF	100	±5%	0.70
12	CL21C330JB61PN □		33pF	50	±5%	0.70
13	CL21C330JC61PN □		33pF	100	±5%	0.70
14	CL21C390JB61PN □		39pF	50	±5%	0.70
15	CL21C390JC61PN □		39pF	100	±5%	0.70
16	CL21C470JB61PN □		47pF	50	±5%	0.70
17	CL21C470JC61PN □		47pF	100	±5%	0.70
18	CL21C560JB61PN □		56pF	50	±5%	0.70
19	CL21C560JC61PN □		56pF	100	±5%	0.70
20	CL21C680JB61PN □		68pF	50	±5%	0.70
21	CL21C680JC61PN □		68pF	100	±5%	0.70
22	CL21C820JB61PN □		82pF	50	±5%	0.70
23	CL21C820JC61PN □		82pF	100	±5%	0.70
24	CL21C101JB61PN □		100pF	50	±5%	0.70
25	CL21C101JC61PN □		100pF	100	±5%	0.70

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

- Part Numbering System
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Product Lineup (Automotive Capacitors-COG)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
26	CL21C121JB61PN □	2.00×1.25	120pF	50	±5%	0.70
27	CL21C121JC61PN □		120pF	100	±5%	0.70
28	CL21C151JB61PN □		150pF	50	±5%	0.70
29	CL21C151JC61PN □		150pF	100	±5%	0.70
30	CL21C221JB61PN □		220pF	50	±5%	0.70
31	CL21C221JC61PN □		220pF	100	±5%	0.70
32	CL21C271JB61PN □		270pF	50	±5%	0.70
33	CL21C271JC61PN □		270pF	100	±5%	0.70
34	CL21C331JB61PN □		330pF	50	±5%	0.70
35	CL21C331JC61PN □		330pF	100	±5%	0.70
36	CL21C471JBC1PN □		470pF	50	±5%	0.95
37	CL21C471JCC1PN □		470pF	100	±5%	0.95
38	CL21C561JBC1PN □		560pF	50	±5%	0.95
39	CL21C561JCC1PN □		560pF	100	±5%	0.95
40	CL21C681JBC1PN □		680pF	50	±5%	0.95
41	CL21C681JCC1PN □		680pF	100	±5%	0.95
42	CL21C821JBC1PN □		820pF	50	±5%	0.95
43	CL21C821JCC1PN □		820pF	100	±5%	0.95
44	CL21C102JBF1PN □		1.0nF	50	±5%	1.35
45	CL21C102JBC1PN □		1.0nF	50	±5%	0.95
46	CL21C102JCF1PN □		1.0nF	100	±5%	1.35
47	CL21C102JCC1PN □		1.0nF	100	±5%	0.95
48	CL21C122JBF1PN □		1.2nF	50	±5%	1.35
49	CL21C122JBC1PN □		1.2nF	50	±5%	0.95
50	CL21C152JBF1PN □		1.5nF	50	±5%	1.35
51	CL21C152JBC1PN □		1.5nF	50	±5%	0.95
52	CL21C182JBF1PN □		1.8nF	50	±5%	1.35
53	CL21C182JBC1PN □		1.8nF	50	±5%	0.95
54	CL21C222JBF1PN □		2.2nF	50	±5%	1.35
55	CL21C222JBC1PN □		2.2nF	50	±5%	0.95
56	CL21C272JBF1PN □		2.7nF	50	±5%	1.35
57	CL21C272JBC1PN □		2.7nF	50	±5%	0.95
58	CL21C332JBF1PN □		3.3nF	50	±5%	1.35
59	CL21C332JBC1PN □		3.3nF	50	±5%	0.95
60	CL21C392JBF1PN □		3.9nF	50	±5%	1.35
61	CL21C392JBC1PN □		3.9nF	50	±5%	0.95
62	CL21C472JBF1PN □		4.7nF	50	±5%	1.35
63	CL21C472JBC1PN □		4.7nF	50	±5%	0.95
64	CL21C562JBF1PN □		5.6nF	50	±5%	1.35
65	CL21C562JBC1PN □		5.6nF	50	±5%	0.95
66	CL21C682JBF1PN □		6.8nF	50	±5%	1.35
67	CL21C822JBF1PN □		8.2nF	50	±5%	1.35
68	CL21C103JBF1PN □		10nF	50	±5%	1.35

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Product Lineup (Automotive Capacitors-X7R)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
1	CL05B331KB5VPN □	1.00×0.50	330 pF	50	±10%	0.55
2	CL05B471KB5VPN □		470 pF	50	±10%	0.55
3	CL05B681KB5VPN □		680 pF	50	±10%	0.55
4	CL05B102KA5VPN □		1.0 nF	25	±10%	0.55
5	CL05B102KB5VPN □		1.0 nF	50	±10%	0.55
6	CL05B152KA5VPN □		1.5 nF	25	±10%	0.55
7	CL05B152KB5VPN □		1.5 nF	50	±10%	0.55
8	CL05B222KA5VPN □		2.2 nF	25	±10%	0.55
9	CL05B222KB5VPN □		2.2 nF	50	±10%	0.55
10	CL05B332KA5VPN □		3.3 nF	25	±10%	0.55
11	CL05B332KB5VPN □		3.3 nF	50	±10%	0.55
12	CL05B472KA5VPN □		4.7 nF	25	±10%	0.55
13	CL05B472KB5VPN □		4.7 nF	50	±10%	0.55
14	CL05B682KA5VPN □		6.8 nF	25	±10%	0.55
15	CL05B682KB5VPN □		6.8 nF	50	±10%	0.55
16	CL05B103KA5VPN □		10 nF	25	±10%	0.55
17	CL05B103KB5VPN □		10 nF	50	±10%	0.55
18	CL05B153KA5VPN □		15 nF	25	±10%	0.55
19	CL05B153KB5VPN □		15 nF	50	±10%	0.55
20	CL05B223KA5VPN □		22 nF	25	±10%	0.55
21	CL05B223KB5VPN □		22 nF	50	±10%	0.55
22	CL05B333K05VPN □		33 nF	16	±10%	0.55
23	CL05B473K05VPN □		47 nF	16	±10%	0.55
24	CL05B683K05VPN □		68 nF	16	±10%	0.55
25	CL05B104K05VPN □		100 nF	16	±10%	0.55

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Part Numbering
System

Standard &
High Capacitors

Super Small Size
Capacitors

High-Q
Capacitors

Medium-High
Voltage Capacitors

Array Type
Capacitors

Low ESL
Capacitors

Reliability Test
Condition

Premium Capacitors
for Automotive
Applications

Packaging
Specification

Application Manual
for Surface Mounting



Product Lineup (Automotive Capacitors-X7R)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
1	CL10B221KC8WPN □	1.60×0.80	220pF	100	±10%	0.90
2	CL10B331KC8WPN □		330pF	100	±10%	0.90
3	CL10B471KC8WPN □		470pF	100	±10%	0.90
4	CL10B681KC8WPN □		680pF	100	±10%	0.90
5	CL10B102KB8WPN □		1.0nF	50	±10%	0.90
6	CL10B102KC8WPN □		1.0nF	100	±10%	0.90
7	CL10B152KB8WPN □		1.5nF	50	±10%	0.90
8	CL10B152KC8WPN □		1.5nF	100	±10%	0.90
9	CL10B222KB8WPN □		2.2nF	50	±10%	0.90
10	CL10B222KC8WPN □		2.2nF	100	±10%	0.90
11	CL10B332KB8WPN □		3.3nF	50	±10%	0.90
12	CL10B332KC8WPN □		3.3nF	100	±10%	0.90
13	CL10B472KB8WPN □		4.7nF	50	±10%	0.90
14	CL10B472KC8WPN □		4.7nF	100	±10%	0.90
15	CL10B682KB8WPN □		6.8nF	50	±10%	0.90
16	CL10B682KC8WPN □		6.8nF	100	±10%	0.90
17	CL10B103KB8WPN □		10nF	50	±10%	0.90
18	CL10B103KC8WPN □		10nF	100	±10%	0.90
19	CL10B153KB8WPN □		15nF	50	±10%	0.90
20	CL10B223KB8WPN □		22nF	50	±10%	0.90
21	CL10B333KA8WPN □		33nF	25	±10%	0.90
22	CL10B333KB8WPN □		33nF	50	±10%	0.90
23	CL10B473KA8WPN □		47nF	25	±10%	0.90
24	CL10B473KB8WPN □		47nF	50	±10%	0.90
25	CL10B683KA8WPN □		68nF	25	±10%	0.90
26	CL10B683KB8WPN □		68nF	50	±10%	0.90
27	CL10B104KA8WPN □		100nF	25	±10%	0.90
28	CL10B104KB8WPN □		100nF	50	±10%	0.90
29	CL10B154KO8VPN □		150nF	16	±10%	0.90
30	CL10B154KA8VPN □		150nF	25	±10%	0.90
31	CL10B224KO8VPN □		220nF	16	±10%	0.90
32	CL10B224KA8VPN □		220nF	25	±10%	0.90
33	CL10B334KO8VPN □		330nF	16	±10%	0.90
34	CL10B334KA8VPN □		330nF	25	±10%	0.90
35	CL10B474KO8VPN □		470nF	16	±10%	0.90
36	CL10B474KA8VPN □		470nF	25	±10%	0.90
37	CL10B684KO8VPN □		680nF	16	±10%	0.90
38	CL10B105KO8VPN □		1.0μF	16	±10%	0.90

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.

Product Lineup (Automotive Capacitors-X7R)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
1	CL21B102KC6WPN □	2.00×1.25	1.0 nF	100	±10%	0.70
2	CL21B152KC6WPN □		1.5 nF	100	±10%	0.70
3	CL21B222KC6WPN □		2.2 nF	100	±10%	0.70
4	CL21B332KC6WPN □		3.3 nF	100	±10%	0.70
5	CL21B472KC6WPN □		4.7 nF	100	±10%	0.70
6	CL21B682KC6WPN □		6.8 nF	100	±10%	0.70
7	CL21B103KC6WPN □		10 nF	100	±10%	0.70
8	CL21B153KC6WPN □		15 nF	100	±10%	0.70
9	CL21B223KC6WPN □		22 nF	100	±10%	0.70
10	CL21B333KCCWPN □		33 nF	100	±10%	0.95
11	CL21B473KCCWPN □		47 nF	100	±10%	0.95
12	CL21B683KCCWPN □		68 nF	100	±10%	0.95
13	CL21B104KBFWPN □		100 nF	50	±10%	1.35
14	CL21B104KBCWPN □		100 nF	50	±10%	0.95
15	CL21B104KCFWPN □		100 nF	100	±10%	1.35
16	CL21B104KCCWPN □		100 nF	100	±10%	0.95
17	CL21B154KAFVFN □		150 nF	25	±10%	1.35
18	CL21B154KBFVFN □		150 nF	50	±10%	1.35
19	CL21B224KAFVFN □		220 nF	25	±10%	1.35
20	CL21B224KBFVFN □		220 nF	50	±10%	1.35
21	CL21B334KAFVFN □		330 nF	25	±10%	1.35
22	CL21B334KBFVFN □		330 nF	50	±10%	1.35
23	CL21B474KOFVFN □		470 nF	16	±10%	1.35
24	CL21B474KAFVFN □		470 nF	25	±10%	1.35
25	CL21B474KBFVFN □		470 nF	50	±10%	1.35
26	CL21B684KOFVFN □		680 nF	16	±10%	1.35
27	CL21B684KAFVFN □		680 nF	25	±10%	1.35
28	CL21B105KOFVFN □		1.0 μF	16	±10%	1.35
29	CL21B105KAFVFN □		1.0 μF	25	±10%	1.35
30	CL21B225KPFVFN □		2.2 μF	10	±10%	1.35
31	CL21B225KOFVFN □		2.2 μF	16	±10%	1.35
32	CL21B335KPQVFN □		3.3 μF	10	±10%	1.40
33	CL21B475KPQVFN □		4.7 μF	10	±10%	1.40
1	CL31B104KBPWPN □	3.20×1.60	100 nF	50	±10%	1.25
2	CL31B104KBCVFN □		100 nF	50	±10%	1.00
3	CL31B154KBPWPN □		150 nF	50	±10%	1.25
4	CL31B224KBPWPN □		220 nF	50	±10%	1.25
5	CL31B334KBHWPN □		330 nF	50	±10%	1.80
6	CL31B474KBHWPN □		470 nF	50	±10%	1.80
7	CL31B684KBHWPN □		680 nF	50	±10%	1.80
8	CL31B105KAPWPN □		1.0 μF	25	±10%	1.25
9	CL31B105KBHWPN □		1.0 μF	50	±10%	1.80
10	CL31B155KAHVFN □		1.5 μF	25	±10%	1.80
11	CL31B155KBHVFN □		1.5 μF	50	±10%	1.80
12	CL31B225KOHVFN □		2.2 μF	16	±10%	1.80
13	CL31B225KAHVFN □		2.2 μF	25	±10%	1.80
14	CL31B225KBHVFN □		2.2 μF	50	±10%	1.80
15	CL31B335KOHVFN □		3.3 μF	16	±10%	1.80
16	CL31B335KAHVFN □		3.3 μF	25	±10%	1.80
17	CL31B475KOHVFN □		4.7 μF	16	±10%	1.80
18	CL31B475KAHVFN □		4.7 μF	25	±10%	1.80
19	CL31B685KOHVFN □		6.8 μF	16	±10%	1.80
20	CL31B106KOHVFN □		10.0 μF	16	±10%	1.80
1	CL32B226KOJVFN □	3.20×2.50	22 μF	16	±10%	2.70

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- Premium Capacitors for Automotive Applications
- Packaging Specification
- Application Manual for Surface Mounting

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p74.



Reliability Test Condition (Automotive Capacitors)

No	Item	Performance	Test Condition															
1	Pre-and Post-Stress Electrical Test	—																
2	High Temperature Exposure	Appearance	No abnormal exterior appearance															
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or $0.25\mu\text{F}$, (Whichever is larger)														
			CLASS II	Within $\pm 10\%$														
		Q	CLASS I	Capacitance $\geq 30\mu\text{F}$: $Q \geq 1,000$ $< 30\mu\text{F}$: $Q \geq 400 + 20 \times C$ (C : Capacitance)														
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.03 max $\geq 16\text{V}$: 0.05 max $\geq 10\text{V}$: 0.075 max *1)														
IR		More than $10,000\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ (Whichever is smaller) *1)																
3	Temperature Cycling	Appearance	No abnormal exterior appearance															
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or $0.25\mu\text{F}$, (Whichever is larger)														
			CLASS II	Within $\pm 10\%$														
		Q	CLASS I	Capacitance $\geq 30\mu\text{F}$: $Q \geq 1,000$ $< 30\mu\text{F}$: $Q \geq 400 + 20 \times C$ (C : Capacitance)														
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.03 max $\geq 16\text{V}$: 0.05 max $\geq 10\text{V}$: 0.075 max *1)														
IR		More than $10,000\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ (Whichever is smaller) *1)																
			1000Cycles															
			Initial Measurement															
			Final Measurement															
			Measurement at 24 ± 2 hrs after test conclusion															
			<table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating Temp. ± 2</td> <td>15 ± 3</td> </tr> <tr> <td>2</td> <td>25 ± 2</td> <td>1</td> </tr> <tr> <td>3</td> <td>Max. operating Temp. ± 2</td> <td>15 ± 3</td> </tr> <tr> <td>4</td> <td>25 ± 2</td> <td>1</td> </tr> </tbody> </table>	Step	Temperature(°C)	Time(min.)	1	Min. operating Temp. ± 2	15 ± 3	2	25 ± 2	1	3	Max. operating Temp. ± 2	15 ± 3	4	25 ± 2	1
Step	Temperature(°C)	Time(min.)																
1	Min. operating Temp. ± 2	15 ± 3																
2	25 ± 2	1																
3	Max. operating Temp. ± 2	15 ± 3																
4	25 ± 2	1																
4	Destructive Physical Analysis	No defects or abnormalities	Per EIA 469															
5	Moisture Resistance	Appearance	No abnormal exterior appearance															
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or $0.25\mu\text{F}$, (Whichever is larger)														
			CLASS II	Within $\pm 12.5\%$														
		Q	CLASS I	Capacitance $\geq 30\mu\text{F}$: $Q \geq 350$ $10 \leq \text{Capacitance} < 30\mu\text{F}$: $Q \geq 275 + (5/2) \times C$ Capacitance $< 10\mu\text{F}$: $Q \geq 200 + 10 \times C$ (C : Capacitance)														
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.03 max $\geq 16\text{V}$: 0.05 max $\geq 10\text{V}$: 0.075 max *1)														
IR		More than $10,000\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ (Whichever is smaller) *1)																
			<p>10Cycles, $t=24$hrs/cycle Heat ($25\text{--}65^\circ\text{C}$) and humidity (80–98%), Unpowered measurement at 24 ± 2hrs after test conclusion</p> <p>The graph shows a temperature profile over 24 hours. The y-axis is temperature in °C (0 to 80) and the x-axis is time in hours (0 to 24). The profile consists of four cycles. Each cycle starts at 25°C, ramps up to 65°C, holds at 65°C for 1 hour, ramps down to 25°C, and holds at 25°C for 1 hour. Humidity levels are indicated as 90-100% RH during the heating and cooling ramps, and 80-100% RH during the 65°C and 25°C hold periods.</p>															

※ *1) : Indicates typical specification. Please refer to individual specifications.

No	Item	Performance	Test Condition	
6	Biased Humidity	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)
			CLASS II	Within $\pm 12.5\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 200$ $< 30\text{pF}$: $Q \geq 100 + (10/3) \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.035 max $\geq 16\text{V}$: 0.05 max $\geq 10\text{V}$: 0.075max *1)
IR		More than 500M Ω or 25M $\Omega \times \mu\text{F}$ (Whichever is Smaller) *1)		
7	High Temperature Operating Life	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 3.0\%$ or 0.3pF, (Whichever is larger)
			CLASS II	Within $\pm 12.5\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 350$ $\geq 10\text{pF}$: $Q \geq 275 + (5/2) \times C$ $< 10\text{pF}$: $Q \geq 200 + 10 \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.035 max $\geq 16\text{V}$: 0.05 max $\geq 10\text{V}$: 0.075max *1)
IR		More than 1,000M Ω or 50M $\Omega \times \mu\text{F}$ (Whichever is smaller) *1)		
8	External Visual	No abnormal exterior appearance	Microscope (x10)	
9	Physical Dimensions	Within the specified dimensions	Using the calipers	
10	Mechanical Shock	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)
			CLASS II	Within $\pm 10\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 1,000$ $< 30\text{pF}$: $Q \geq 400 + 20 \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.025 max $\geq 16\text{V}$: 0.035 max $\geq 10\text{V}$: 0.05 max *1)
IR		More than 10,000M Ω or 500M $\Omega \times \mu\text{F}$ (Whichever is smaller) *1)		

※ *1) : Indicates typical specification. Please refer to individual specifications.

*2) : Some of the parts are applicable in rated voltage 150%, Please refer to individual specifications.

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No	Item	Performance	Test Condition	
11	Vibration	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)
			CLASS II	Within $\pm 10\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 1,000$ $< 30\text{pF}$: $Q \geq 400+20 \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.025 max $\geq 16\text{V}$: 0.035 max $\geq 10\text{V}$: 0.05max *1)
IR		More than 10,000M Ω or 500M $\Omega \times \mu\text{F}$ (Whichever is smaller) *1)		
12	Resistance to Solder Heat	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)
			CLASS II	Within $\pm 10\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 1,000$ $< 30\text{pF}$: $Q \geq 400+20 \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.025 max $\geq 16\text{V}$: 0.035 max $\geq 10\text{V}$: 0.05max *1)
IR		More than 10,000M Ω or 500M $\Omega \times \mu\text{F}$ (Whichever is smaller) *1)		
13	Thermal Shock	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)
			CLASS II	Within $\pm 10\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 1,000$ $< 30\text{pF}$: $Q \geq 400+20 \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.025 max $\geq 16\text{V}$: 0.035 max $\geq 10\text{V}$: 0.05max *1)
IR		More than 10,000M Ω or 500M $\Omega \times \mu\text{F}$ (Whichever is smaller) *1)		
14	ESD	Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I	Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)
			CLASS II	Within $\pm 10\%$
		Q	CLASS I	Capacitance $\geq 30\text{pF}$: $Q \geq 1,000$ $< 30\text{pF}$: $Q \geq 400+20 \times C$ (C : Capacitance)
		Tan δ	CLASS II	Rated Voltage $\geq 25\text{V}$: 0.025 max $\geq 16\text{V}$: 0.035 max $\geq 10\text{V}$: 0.05max *1)
IR		More than 10,000M Ω or 500M $\Omega \times \mu\text{F}$ (Whichever is smaller) *1)		

※ *1) : Indicates typical specification. Please refer to individual specifications.

No	Item		Performance	Test Condition																		
15	Solderability		95% of the terminations is to be soldered evenly and continuously	a) Preheat at 155°C for 4 hrs, Immerse in solder for 5s at 235±5°C b) Steam aging for 8 hrs, Immerse in solder for 5s at 235±5°C c) Steam aging for 8 hrs, Immerse in solder for 120s at 260±5°C solder : a solution ethanol and rosin																		
16	Electrical Characterization	Capacitance	Within specified tolerance	The Capacitance /D.F. should be measured at 25°C, *A capacitor prior to measuring the capacitance is heat treated at 150+0/-10°C and maintained in ambient air for 24±2hrs. <table border="1" data-bbox="874 555 1369 689"> <thead> <tr> <th>Class</th> <th>Capacitance</th> <th>Frequency</th> <th>Vrms</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Class I</td> <td>1000pF ↓</td> <td>1kHz ±10%</td> <td>0.5~5Vrms</td> </tr> <tr> <td>1000pF ↑</td> <td>1kHz ±10%</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td rowspan="2">Class II</td> <td>10μF ↓</td> <td>1kHz ±10%</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td>10μF ↑</td> <td>120Hz ±20%</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table> Initial measurement Perform a heat treatment at 150+0/-10°C for one hour after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement. I.R. should be measured with a DC voltage not exceeding Rated Voltage @25°C , @125°C for 60~120 sec. Dielectric Strength : 250% of the rated voltage for 1~5 seconds The charge/discharge current is less than 50mA.	Class	Capacitance	Frequency	Vrms	Class I	1000pF ↓	1kHz ±10%	0.5~5Vrms	1000pF ↑	1kHz ±10%	1.0±0.2Vrms	Class II	10μF ↓	1kHz ±10%	1.0±0.2Vrms	10μF ↑	120Hz ±20%	0.5±0.1Vrms
		Class	Capacitance		Frequency	Vrms																
		Class I	1000pF ↓		1kHz ±10%	0.5~5Vrms																
			1000pF ↑		1kHz ±10%	1.0±0.2Vrms																
		Class II	10μF ↓		1kHz ±10%	1.0±0.2Vrms																
			10μF ↑		120Hz ±20%	0.5±0.1Vrms																
		Q	CLASS I		Capacitance ≥ 30pF : Q ≥ 1,000 < 30pF : Q ≥ 400+20×C (C : Capacitance)																	
Tanδ	CLASS II	Rated Voltage ≥ 25V : 0.025 max ≥ 16V : 0.035 max ≥ 10V : 0.05max *1)																				
IR@25°C	CLASS I	More than 100,000MΩ or 1,000 MΩ × μF (Whichever is smaller)																				
	CLASS II	More than 10,000MΩ or 500 MΩ × μF (Whichever is smaller)																				
IR@125°C	CLASS I	More than 10,000MΩ or 100 MΩ × μF (Whichever is smaller)																				
	CLASS II	More than 1,000MΩ or 10 MΩ × μF (Whichever is smaller)																				
Dielectric Strength		No dielectric breakdown or mechanical breakdown																				
17	Appearance		No abnormal exterior appearance	Bending to the limit for 60 seconds Limit : Class I -3mm Class II - 3mm The figure indicates typical specification. Please refer to individual specifications Initial Measurement Perform a heat treatment at 150+0/-10°C for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement. Final measurement Let measure within 24hrs at room temperature after test conclusion.																		
	Capacitance Change	CLASS I	Within ± 5.0% or 0.5pF, (Whichever is larger)																			
		CLASS II	Within ± 10%																			
18	Appearance		No abnormal exterior appearance	18N, for 60±1 sec. * 0603(1608) -10N, 0402(1005) -2N Initial Measurement Perform a heat treatment at 150+0/-10°C for 1hr after soldering process. And then let sit for 24±2hrs at room temperature. Perform the initial measurement. Final measurement Let measure within 24hrs at room temperature after test conclusion.																		
	Capacitance Change	CLASS I	Within ± 2.5% or 0.25pF, (Whichever is larger)																			
		CLASS II	Within ± 10%																			
19	Beam Load		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	Beam speed Chip Length ≤ 2.5mm , 0.5±0.05mm/sec Chip Length ≥ 3.2mm , 2.5±0.25mm/sec																		
20	Capacitance Change	CLASS I	0±30 ppm/°C	<table border="1" data-bbox="874 1787 1369 1953"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> <th>Time(min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25 ± 2</td> <td>1</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp. ±2</td> <td>15±3</td> </tr> <tr> <td>3</td> <td>25 ± 2</td> <td>1</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp. ±2</td> <td>15±3</td> </tr> <tr> <td>5</td> <td>25 ± 2</td> <td>1</td> </tr> </tbody> </table>	Step	Temperature(°C)	Time(min)	1	25 ± 2	1	2	Min. Operating Temp. ±2	15±3	3	25 ± 2	1	4	Max. Operating Temp. ±2	15±3	5	25 ± 2	1
		Step	Temperature(°C)		Time(min)																	
	1	25 ± 2	1																			
	2	Min. Operating Temp. ±2	15±3																			
3	25 ± 2	1																				
4	Max. Operating Temp. ±2	15±3																				
5	25 ± 2	1																				
CLASS II	Within ± 15%																					
Temperature Coefficient	CLASS I	0±30 ppm/°C																				
Capacitance Drift	CLASS I	Within ± 0.2% or 0.05pF, (Whichever is larger)																				

※ *1) : Indicates typical specification. Please refer to individual specifications.

*If you want more detailed information, Please Visit Samsung Electro-mechanics website (www.semclcr.com)

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