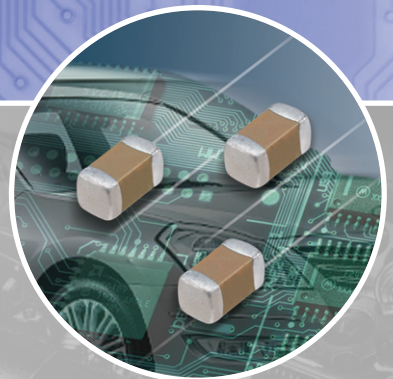




Premium Capacitors for Automotive Applications



**SAMSUNG
ELECTRO-MECHANICS**

SAMSUNG

Part Numbering System (Automotive Capacitors)

	CL	10	B	104	K	B	8	5	P	N	C
	1	2	3	4	5	6	7	8	9	10	11
1. SERIES CODE											
CL=Multi layer Ceramic Capacitors											
2. SIZE CODE											
inch (mm)											
05=1005(0402) 10=1608(0603) 21=2012(0805)											
31=3216(1206) 32=3225(1210)											
3. DIELECTRIC CODE											
C=C0G (Class I) B=X7R (Class II)											
4. CAPACITANCE CODE											
Capacitance expressed in pF. 2 significant digits plus number of zeros. example) 106=10 × 10 ⁶ =10000000pF For Values < 10pF, Letter R denotes decimal point example) 1R5=1.5pF											
5. TOLERANCE CODE											
C=±0.25pF D=±0.5pF F=±1pF, ±1%* G=±2% J=±5% K=±10% M=±20% *For Values ≤10pF, F=±1pF, Values>10pF, F=±1% ※This code has only typical specifications. Please refer to individual specifications.											
6. RATED VOLTAGE CODE											
P=10V O=16V A=25V B=50V C=100V											
7. THICKNESS CODE											
5 = 0.50mm 6= 0.60mm 8 = 0.80mm C = 0.85mm P = 1.15mm F = 1.25mm H = 1.60mm J = 2.50mm ※This code has only typical specifications. Please refer to individual specifications.											
8. DESIGN CODE											
1=Ni/Cu/Ni Barrier/Sn 100%/Standard 4=Ni/Cu+Soft termination/Ni Barrier/Sn 100%/Standard 5=Ni/Cu+Soft termination/Ni Barrier/Sn 100%/Open Mode ※This code has only typical specifications. Please refer to individual specifications.											
9. PRODUCT CODE											
P=Automotive product meet AEC-Q-200. ※If orders are placed without returned specification, please allow us to judge that specification is accepted by your side.											
10. GRADE CODE											
N=Standard											
11. PACKAGING CODE											
B = Bulk O = Cardboard Tape, 10" Reel E = Embossed Type, 7" Reel P = Bulk Case D = Cardboard Tape, 13" Reel(10,000ea) F = Embossed Type, 13" Reel C = Cardboard Tape, 7" Reel L = Cardboard Tape, 13" Reel(15,000ea) S = Embossed Type, 10" Reel											

This catalog has only typical specifications because there is no space for detailed specifications.
Please approve our product specifications or transact the approval sheet for product specifications before ordering.

★
Class I

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

Class II

Symbol	EIA Code	Operation Temperature Range(°C)	Capacitance Change (ΔC %)
B	X7R	-55 ~ +125	0 ±15

★★
Capacitance Tolerance

Code	Capacitance Tolerance	TC	Capacitance Step	Rated Capacitance
C	± 0.25 pF	COG	Under 5 pF	E-12 series ★
D	± 0.5 pF	COG	6.0 to 9.0 pF	E-12 series ★
J	± 5 %	COG	Over 10 pF	E-12 series
K	± 10 %	X7R	Under 0.01 μF	E-3 series
			Over 0.01 μF	E-6 series
M	± 20 %	X7R	Under 0.01 μF	E-3 series
			Over 0.01 μF	E-6 series

★E-24 series is also available

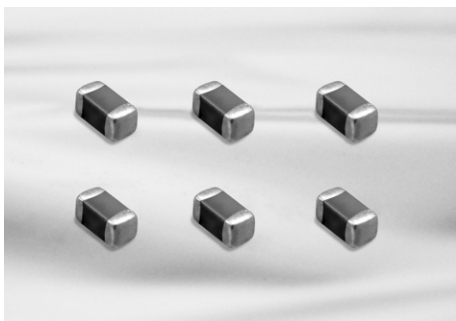
Series	Capacitance Step											
E-3	1.0				2.2				4.7			
E-6	1.0		1.5		2.2		3.3		4.7		6.8	
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
E-24	1.0	1.1	1.2	1.3	2.2	2.4	2.7	3.0	4.7	5.1	5.6	6.2
	1.5	1.6	1.8	2.0	3.3	3.6	3.9	4.3	6.8	7.5	8.2	9.1

★★★

Size	Code	Thickness(mm)	Spec(mm) ★
0402(1005)	5	0.50	±0.05
0603(1608)	8	0.80	±0.10
0805(2012)	6	0.60	±0.10
	C	0.85	±0.10
	F	1.25	±0.10
1206(3216)	C	0.85	±0.15
	P	1.15	±0.10
	H	1.60	±0.20

★The tolerance will be changed by Customer' standards and our new products. (High Capacitance)
Please check with our sales representatives or product engineers before ordering.

Part Numbering
SystemGeneral
CapacitorsHigh Capacitance
CapacitorsSuper Small Size
CapacitorsMedium-High
Voltage CapacitorsArray Type
CapacitorsLow ESL
CapacitorsReliability Test
ConditionPremium Capacitors
for Automotive
ApplicationsPackaging
SpecificationApplication Manual
for Surface Mounting



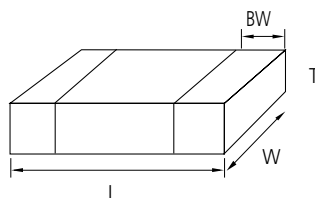
Feature

- 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	$0.50 (\pm 0.05)$	0.25 ± 0.10
10	0603	1.60 ± 0.10	0.80 ± 0.10	$0.80 (\pm 0.10)$	0.3 ± 0.2
21	0805	2.00 ± 0.10	1.25 ± 0.10	$0.60 (\pm 0.10)$	$0.5+0.2/-0.3$
				$0.85 (\pm 0.10)$	
				$1.25 (\pm 0.10)$	
31	1206	3.20 ± 0.20	1.60 ± 0.20	$0.85 (\pm 0.15)$	0.5 ± 0.3
				$1.15 (\pm 0.10)$	
				$1.60 (\pm 0.20)$	

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										
			100										
	0603(1608)	0.80	50										
			100										
	0805(2012)	0.60	50										
		0.85											
		1.25	100										

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

Part Numbering
SystemGeneral
CapacitorsHigh Capacitance
CapacitorsSuper Small Size
CapacitorsMedium-High
Voltage CapacitorsArray Type
CapacitorsLow ESL
CapacitorsReliability Test
ConditionPremium Capacitors
for Automotive
ApplicationsPackaging
SpecificationApplication Manual
for Surface Mounting

Product Lineup (Automotive Capacitors_COG)

	Part Number	Size L×W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max. (mm)
1	CL05C010CB51PN □	1.00×0.50	1.0pF	50	±0.25pF	0.55
2	CL05C010CC51PN □		1.0pF	100	±0.25pF	0.55
3	CL05C1R5CB51PN □		1.5pF	50	±0.25pF	0.55
4	CL05C1R5CC51PN □		1.5pF	100	±0.25pF	0.55
5	CL05C2R2CB51PN □		2.2pF	50	±0.25pF	0.55
6	CL05C2R2CC51PN □		2.2pF	100	±0.25pF	0.55
7	CL05C3R3CB51PN □		3.3pF	50	±0.25pF	0.55
8	CL05C3R3CC51PN □		3.3pF	100	±0.25pF	0.55
9	CL05C4R7CB51PN □		4.7pF	50	±0.25pF	0.55
10	CL05C4R7CC51PN □		4.7pF	100	±0.25pF	0.55
11	CL05C6R8DB51PN □		6.8pF	50	±0.5pF	0.55
12	CL05C6R8DC51PN □		6.8pF	100	±0.5pF	0.55
13	CL05C100JB51PN □		10pF	50	±5%	0.55
14	CL05C100JC51PN □		10pF	100	±5%	0.55
15	CL05C120JB51PN □		12pF	50	±5%	0.55
16	CL05C120JC51PN □		12pF	100	±5%	0.55
17	CL05C150JB51PN □		15pF	50	±5%	0.55
18	CL05C150JC51PN □		15pF	100	±5%	0.55
19	CL05C180JB51PN □		18pF	50	±5%	0.55
20	CL05C180JC51PN □		18pF	100	±5%	0.55
21	CL05C220JB51PN □		22pF	50	±5%	0.55
22	CL05C220JC51PN □		22pF	100	±5%	0.55
23	CL05C270JB51PN □		27pF	50	±5%	0.55
24	CL05C270JC51PN □		27pF	100	±5%	0.55
25	CL05C330JB51PN □		33pF	50	±5%	0.55
26	CL05C330JC51PN □		33pF	100	±5%	0.55
27	CL05C390JB51PN □		39pF	50	±5%	0.55
28	CL05C390JC51PN □		39pF	100	±5%	0.55
29	CL05C470JB51PN □		47pF	50	±5%	0.55
30	CL05C470JC51PN □		47pF	100	±5%	0.55
31	CL05C560JB51PN □		56pF	50	±5%	0.55
32	CL05C560JC51PN □		56pF	100	±5%	0.55
33	CL05C680JB51PN □		68pF	50	±5%	0.55
34	CL05C680JC51PN □		68pF	100	±5%	0.55
35	CL05C820JB51PN □		82pF	50	±5%	0.55
36	CL05C820JC51PN □		82pF	100	±5%	0.55
37	CL05C101JB51PN □		100pF	50	±5%	0.55
38	CL05C101JC51PN □		100pF	100	±5%	0.55
39	CL05C121JB51PN □		120pF	50	±5%	0.55
40	CL05C151JB51PN □		150pF	50	±5%	0.55
41	CL05C221JB51PN □		220pF	50	±5%	0.55
1	CL10C010CB81PN □	1.60×0.80	1.0pF	50	±0.25pF	0.9
2	CL10C010CC81PN □		1.0pF	100	±0.25pF	0.9
3	CL10C1R5CB81PN □		1.5pF	50	±0.25pF	0.9
4	CL10C1R5CC81PN □		1.5pF	100	±0.25pF	0.9

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p80.

Product Lineup (Automotive Capacitors_COG)

	Part Number	Size L × W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max. (mm)
5	CL10C2R2CB81PN □	1.60 × 0.80	2.2 pF	50	±0.25 pF	0.9
6	CL10C2R2CC81PN □		2.2 pF	100	±0.25 pF	0.9
7	CL10C3R3CB81PN □		3.3 pF	50	±0.25 pF	0.9
8	CL10C3R3CC81PN □		3.3 pF	100	±0.25 pF	0.9
9	CL10C4R7CB81PN □		4.7 pF	50	±0.25 pF	0.9
10	CL10C4R7CC81PN □		4.7 pF	100	±0.25 pF	0.9
11	CL10C6R8DB81PN □		6.8 pF	50	±0.5 pF	0.9
12	CL10C6R8DC81PN □		6.8 pF	100	±0.5 pF	0.9
13	CL10C100JB81PN □		10 pF	50	±5%	0.9
14	CL10C100JC81PN □		10 pF	100	±5%	0.9
15	CL10C120JB81PN □		12 pF	50	±5%	0.9
16	CL10C120JC81PN □		12 pF	100	±5%	0.9
17	CL10C150JB81PN □		15 pF	50	±5%	0.9
18	CL10C150JC81PN □		15 pF	100	±5%	0.9
19	CL10C180JB81PN □		18 pF	50	±5%	0.9
20	CL10C180JC81PN □		18 pF	100	±5%	0.9
21	CL10C220JB81PN □		22 pF	50	±5%	0.9
22	CL10C220JC81PN □		22 pF	100	±5%	0.9
23	CL10C270JB81PN □		27 pF	50	±5%	0.9
24	CL10C270JC81PN □		27 pF	100	±5%	0.9
25	CL10C330JB81PN □		33 pF	50	±5%	0.9
26	CL10C330JC81PN □		33 pF	100	±5%	0.9
27	CL10C390JB81PN □		39 pF	50	±5%	0.9
28	CL10C390JC81PN □		39 pF	100	±5%	0.9
29	CL10C470JB81PN □		47 pF	50	±5%	0.9
30	CL10C470JC81PN □		47 pF	100	±5%	0.9
31	CL10C560JB81PN □		56 pF	50	±5%	0.9
32	CL10C560JC81PN □		56 pF	100	±5%	0.9
33	CL10C680JB81PN □		68 pF	50	±5%	0.9
34	CL10C680JC81PN □		68 pF	100	±5%	0.9
35	CL10C820JB81PN □		82 pF	50	±5%	0.9
36	CL10C820JC81PN □		82 pF	100	±5%	0.9
37	CL10C101JB81PN □		100 pF	50	±5%	0.9
38	CL10C101JC81PN □		100 pF	100	±5%	0.9
39	CL10C121JB81PN □		120 pF	50	±5%	0.9
40	CL10C151JB81PN □		150 pF	50	±5%	0.9
41	CL10C221JB81PN □		220 pF	50	±5%	0.9
42	CL10C271JB81PN □		270 pF	50	±5%	0.9
43	CL10C331JB81PN □		330 pF	50	±5%	0.9
44	CL10C391JB81PN □		390 pF	50	±5%	0.9
45	CL10C471JB81PN □		470 pF	50	±5%	0.9
46	CL10C561JB81PN □		560 pF	50	±5%	0.9
47	CL10C681JB81PN □		680 pF	50	±5%	0.9
48	CL10C821JB81PN □		820 pF	50	±5%	0.9
49	CL10C102JB81PN □		1 nF	50	±5%	0.9

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p80.

Part Numbering
SystemGeneral
CapacitorsHigh Capacitance
CapacitorsSuper Small Size
CapacitorsMedium-High
Voltage CapacitorsArray Type
CapacitorsLow ESL
CapacitorsReliability Test
ConditionPremium Capacitors
for Automotive
ApplicationsPackaging
SpecificationApplication Manual
for Surface Mounting

Product Lineup (Automotive Capacitors_COG)

	Part Number	Size L×W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max. (mm)
1	CL21C100JB61PN □	2.00×1.25	10pF	50	±5%	0.7
2	CL21C100JC61PN □		10pF	100	±5%	0.7
3	CL21C120JB61PN □		12pF	50	±5%	0.7
4	CL21C120JC61PN □		12pF	100	±5%	0.7
5	CL21C150JB61PN □		15pF	50	±5%	0.7
6	CL21C150JC61PN □		15pF	100	±5%	0.7
7	CL21C180JB61PN □		18pF	50	±5%	0.7
8	CL21C180JC61PN □		18pF	100	±5%	0.7
9	CL21C220JB61PN □		22pF	50	±5%	0.7
10	CL21C220JC61PN □		22pF	100	±5%	0.7
11	CL21C270JC61PN □		27pF	100	±5%	0.7
12	CL21C330JB61PN □		33pF	50	±5%	0.7
13	CL21C330JC61PN □		33pF	100	±5%	0.7
14	CL21C390JB61PN □		39pF	50	±5%	0.7
15	CL21C390JC61PN □		39pF	100	±5%	0.7
16	CL21C470JB61PN □		47pF	50	±5%	0.7
17	CL21C470JC61PN □		47pF	100	±5%	0.7
18	CL21C560JB61PN □		56pF	50	±5%	0.7
19	CL21C560JC61PN □		56pF	100	±5%	0.7
20	CL21C680JB61PN □		68pF	50	±5%	0.7
21	CL21C680JC61PN □		68pF	100	±5%	0.7
22	CL21C820JB61PN □		82pF	50	±5%	0.7
23	CL21C820JC61PN □		82pF	100	±5%	0.7
24	CL21C101JB61PN □		100pF	50	±5%	0.7
25	CL21C101JC61PN □		100pF	100	±5%	0.7
26	CL21C121JB61PN □		120pF	50	±5%	0.7
27	CL21C121JC61PN □		120pF	100	±5%	0.7
28	CL21C151JB61PN □		150pF	50	±5%	0.7
29	CL21C151JC61PN □		150pF	100	±5%	0.7
30	CL21C221JB61PN □		220pF	50	±5%	0.7
31	CL21C221JC61PN □		220pF	100	±5%	0.7
32	CL21C271JB61PN □		270pF	50	±5%	0.7
33	CL21C271JC61PN □		270pF	100	±5%	0.7
34	CL21C331JB61PN □		330pF	50	±5%	0.7

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p80.

Product Lineup (Automotive Capacitors_COG)

	Part Number	Size L × W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max. (mm)
35	CL21C331JC61PN □	2.00 × 1.25	330pF	100	±5%	0.7
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	CL21C102JBC1PN □		1nF	50	±5%	0.95
45	CL21C102JCC1PN □		1nF	100	±5%	0.95
46	CL21C102JCF1PN □		1nF	100	±5%	1.35
47	CL21C122JBC1PN □		1.2nF	50	±5%	0.95
48	CL21C152JBC1PN □		1.5nF	50	±5%	0.95
49	CL21C182JBC1PN □		1.8nF	50	±5%	0.95
50	CL21C222JBC1PN □		2.2nF	50	±5%	0.95
51	CL21C272JBC1PN □		2.7nF	50	±5%	0.95
52	CL21C332JBC1PN □		3.3nF	50	±5%	0.95
53	CL21C392JBC1PN □		3.9nF	50	±5%	0.95
54	CL21C472JBC1PN □		4.7nF	50	±5%	0.95
55	CL21C562JBC1PN □		5.6nF	50	±5%	0.95
56	CL21C102JBF1PN □		1nF	50	±5%	1.35
57	CL21C122JBF1PN □		1.2nF	50	±5%	1.35
58	CL21C152JBF1PN □		1.5nF	50	±5%	1.35
59	CL21C182JBF1PN □		1.8nF	50	±5%	1.35
60	CL21C222JBF1PN □		2.2nF	50	±5%	1.35
61	CL21C272JBF1PN □		2.7nF	50	±5%	1.35
62	CL21C332JBF1PN □		3.3nF	50	±5%	1.35
63	CL21C392JBF1PN □		3.9nF	50	±5%	1.35
64	CL21C472JBF1PN □		4.7nF	50	±5%	1.35
65	CL21C562JBF1PN □		5.6nF	50	±5%	1.35
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 p80.

Part Numbering System

General Capacitors

High Capacitance Capacitors

Super Small Size 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×W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max. (mm)
1	CL05B223KB54PN □	1.00×0.50	22nF	50	±10%	0.55
2	CL05B104KO54PN □		100nF	16	±10%	0.55
1	CL10B221KC85PN □	1.60×0.80	220pF	100	±10%	0.90
2	CL10B471KC85PN □		470pF	100	±10%	0.90
3	CL10B102KB85PN □		1.0nF	50	±10%	0.90
4	CL10B102KC85PN □		1.0nF	100	±10%	0.90
5	CL10B222KB85PN □		2.2nF	50	±10%	0.90
6	CL10B222KC85PN □		2.2nF	100	±10%	0.90
7	CL10B472KB85PN □		4.7nF	50	±10%	0.90
8	CL10B472KC85PN □		4.7nF	100	±10%	0.90
9	CL10B103KA85PN □		10nF	25	±10%	0.90
10	CL10B103KB85PN □		10nF	50	±10%	0.90
11	CL10B103KC85PN □		10nF	100	±10%	0.90
12	CL10B153KA85PN □		15nF	25	±10%	0.90
13	CL10B153KB85PN □		15nF	50	±10%	0.90
14	CL10B223KA85PN □		22nF	25	±10%	0.90
15	CL10B223KB85PN □		22nF	50	±10%	0.90
16	CL10B333KA85PN □		33nF	25	±10%	0.90
17	CL10B333KB85PN □		33nF	50	±10%	0.90
18	CL10B473KO85PN □		47nF	16	±10%	0.90
19	CL10B473KA85PN □		47nF	25	±10%	0.90
20	CL10B473KB85PN □		47nF	50	±10%	0.90
21	CL10B683KO85PN □		68nF	16	±10%	0.90
22	CL10B683KA85PN □		68nF	25	±10%	0.90
23	CL10B683KB85PN □		68nF	50	±10%	0.90
24	CL10B104KO85PN □		100nF	16	±10%	0.90
25	CL10B104KA85PN □		100nF	25	±10%	0.90
26	CL10B104KB85PN □		100nF	50	±10%	0.90
27	CL10B154KO84PN □		150nF	16	±10%	0.90
28	CL10B154KA84PN □		150nF	25	±10%	0.90
29	CL10B224KO84PN □		220nF	16	±10%	0.90
30	CL10B224KA84PN □		220nF	25	±10%	0.90
31	CL10B334KO84PN □		330nF	16	±10%	0.90
32	CL10B334KA84PN □		330nF	25	±10%	0.90
33	CL10B474KO84PN □		470nF	16	±10%	0.90
34	CL10B474KA84PN □		470nF	25	±10%	0.90
35	CL10B105KO84PN □		1μF	16	±10%	0.90
1	CL21B102KB65PN □	2.00×1.25	1.0nF	50	±10%	0.70
2	CL21B102KC65PN □		1.0nF	100	±10%	0.70
3	CL21B222KB65PN □		2.2nF	50	±10%	0.70
4	CL21B222KC65PN □		2.2nF	100	±10%	0.70
5	CL21B472KB65PN □		4.7nF	50	±10%	0.70
6	CL21B472KC65PN □		4.7nF	100	±10%	0.70
7	CL21B103KB65PN □		10nF	50	±10%	0.70
8	CL21B103KC65PN □		10nF	100	±10%	0.70
9	CL21B153KB65PN □		15nF	50	±10%	0.70
10	CL21B153KC65PN □		15nF	100	±10%	0.70
11	CL21B223KB65PN □		22nF	50	±10%	0.70
12	CL21B223KC65PN □		22nF	100	±10%	0.70

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p80.

Product Lineup (Automotive Capacitors_X7R)

	Part Number	Size L × W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max. (mm)
13	CL21B333KBC5PN □	2.00 × 1.25	33 nF	50	±10%	0.95
14	CL21B333KCC5PN □		33 nF	100	±10%	0.95
15	CL21B473KAC5PN □		47 nF	25	±10%	0.95
16	CL21B473KBC5PN □		47 nF	50	±10%	0.95
17	CL21B473KCC5PN □		47 nF	100	±10%	0.95
18	CL21B683KAC5PN □		68 nF	25	±10%	0.95
19	CL21B683KBC5PN □		68 nF	50	±10%	0.95
20	CL21B683KCC5PN □		68 nF	100	±10%	0.95
21	CL21B104KOC5PN □		100 nF	16	±10%	0.95
22	CL21B104KAC5PN □		100 nF	25	±10%	0.95
23	CL21B104KBC5PN □		100 nF	50	±10%	0.95
24	CL21B104KBF5PN □		100 nF	50	±10%	1.35
25	CL21B104KCC5PN □		100 nF	100	±10%	0.95
26	CL21B104KCF5PN □		100 nF	100	±10%	1.35
27	CL21B154KOF4PN □		150 nF	16	±10%	1.35
28	CL21B154KAF4PN □		150 nF	25	±10%	1.35
29	CL21B154KBF4PN □		150 nF	50	±10%	1.35
30	CL21B224KOF4PN □		220 nF	16	±10%	1.35
31	CL21B224KAF4PN □		220 nF	25	±10%	1.35
32	CL21B224KBF4PN □		220 nF	50	±10%	1.35
33	CL21B334KOF4PN □		330 nF	16	±10%	1.35
34	CL21B334KAF4PN □		330 nF	25	±10%	1.35
35	CL21B334KBF4PN □		330 nF	50	±10%	1.35
36	CL21B474KOF4PN □		470 nF	16	±10%	1.35
37	CL21B474KAF4PN □		470 nF	25	±10%	1.35
38	CL21B474KBF4PN □		470 nF	50	±10%	1.35
39	CL21B684KOF4PN □		680 nF	16	±10%	1.35
40	CL21B684KAF4PN □		680 nF	25	±10%	1.35
41	CL21B105KOF4PN □		1 μF	16	±10%	1.35
42	CL21B105KAF4PN □		1 μF	25	±10%	1.35
43	CL21B225KOF4PN □		2.2 μF	16	±10%	1.35
1	CL31B104KBC5PN □	3.20 × 1.60	100 nF	50	±10%	1.00
2	CL31B154KBP5PN □		150 nF	50	±10%	1.25
3	CL31B224KAC5PN □		220 nF	25	±10%	1.00
4	CL31B224KBP5PN □		220 nF	50	±10%	1.25
5	CL31B334KAC5PN □		330 nF	25	±10%	1.00
6	CL31B334KBH5PN □		330 nF	50	±10%	1.80
7	CL31B474KAC5PN □		470 nF	25	±10%	1.00
8	CL31B474KBH5PN □		470 nF	50	±10%	1.80
9	CL31B684KAP5PN □		680 nF	25	±10%	1.25
10	CL31B684KBH5PN □		680 nF	50	±10%	1.80
11	CL31B105KOP5PN □		1 μF	16	±10%	1.25
12	CL31B105KAP5PN □		1 μF	25	±10%	1.25
13	CL31B105KBH5PN □		1 μF	50	±10%	1.80
14	CL31B155KOH4PN □		1.5 μF	16	±10%	1.80
15	CL31B155KAH4PN □		1.5 μF	25	±10%	1.80
16	CL31B155KBH4PN □		1.5 μF	50	±10%	1.80
17	CL31B225KOH4PN □		2.2 μF	16	±10%	1.80
18	CL31B225KAH4PN □		2.2 μF	25	±10%	1.80
19	CL31B225KBH4PN □		2.2 μF	50	±10%	1.80

※ □ mark means packaging code. If you want to learn the code or quantity in detail, please see p80.

Part Numbering
SystemGeneral
CapacitorsHigh Capacitance
CapacitorsSuper Small Size
CapacitorsMedium-High
Voltage CapacitorsArray Type
CapacitorsLow ESL
CapacitorsReliability Test
ConditionPremium Capacitors
for Automotive
ApplicationsPackaging
SpecificationApplication Manual
for Surface Mounting

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	Unpowered, 1000hrs@T=150℃ Measurement at 24±2hrs after test conclusion
		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 × C (C : Capacitance)	
		Tanδ	CLASS II Rated Voltage ≥ 25V : 0.03 max ≥ 16V : 0.05 max ≥ 10V : 0.075 max	
3	Temperature Cycling	IR	More than 10,000 MΩ or 500 MΩ × μF (Whichever is smaller)	1000Cycles Measurement at 24±2hrs after test conclusion
		Appearance	No abnormal exterior appearance	
		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 × C (C : Capacitance)	
4	Destructive Physical Analysis	Tanδ	CLASS II Rated Voltage ≥ 25V : 0.03 max ≥ 16V : 0.05 max ≥ 10V : 0.075max	Per EIA 469
		IR	More than 10,000 MΩ or 500 MΩ × μF (Whichever is smaller)	
		IR	More than 10,000 MΩ or 500 MΩ × μF (Whichever is smaller)	
5	Moisture Resistance	Appearance	No abnormal exterior appearance	10Cycles, t=24hrs/cycle Heat (25~65℃) and humidity (80~98%), Unpowered measurement at 24±2hrs after test conclusion
		Capacitance Change	CLASS I Within ±2.5% or 0.25pF, (Whichever is larger)	
			CLASS II Within ±12.5%	
		Q	CLASS I Capacitance ≥ 30pF : Q ≥ 350 10≤Capacitance< 30pF : Q ≥ 275+(5/2) × C Capacitance < 10pF : Q ≥ 200+10 × C (C : Capacitance)	
		Tanδ	CLASS II Rated Voltage ≥ 25V : 0.03 max ≥ 16V : 0.05 max ≥ 10V : 0.075max	
5	Moisture Resistance	IR	More than 10,000 MΩ or 500 MΩ × μF (Whichever is smaller)	The graph shows a temperature cycle over 24 hours. The temperature starts at 25°C, rises to 65°C at 4 hours, stays at 65°C for 4 hours (RH 90~100%), falls to 25°C at 8 hours, stays at 25°C for 4 hours (RH 80~100%), rises to 65°C at 12 hours, stays at 65°C for 4 hours (RH 90~100%), falls to 25°C at 16 hours, stays at 25°C for 4 hours (RH 80~100%), and finally rises to 65°C at 20 hours. The y-axis is Temperature (°C) from 0 to 80. The x-axis is Time (Hours) from 0 to 24.
		IR	More than 10,000 MΩ or 500 MΩ × μF (Whichever is smaller)	
		IR	More than 10,000 MΩ or 500 MΩ × μF (Whichever is smaller)	

No	Item		Performance	Test Condition						
6	Biased Humidity	Appearance	No abnormal exterior appearance	1000hrs 85℃/85%RH, Rated Voltate and 1.3~1.5V, (add 100kohm resistor) Measurement at 24±2hrs after test conclusion The charge/discharge current is less than 50mA.						
		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)×C (C : Capacitance)					
		Tanδ	CLASS II		Rated Voltage ≥ 25V : 0.035 max ≥ 16V : 0.05 max ≥ 10V : 0.075max					
	IR		More than 500 MΩor 25 MΩ × μF (Whichever is Smaller)							
7	High Temperature Operating Life	Appearance	No abnormal exterior appearance	1000hrs @ TA=125℃, 200% Rated Voltage, Measurement at 24±2hrs after test conclusion The charge/discharge current is less than 50mA.						
		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+(5/2)×C < 10pF : Q≥200+10×C (C : Capacitance)					
		Tanδ	CLASS II		Rated Voltage ≥ 25V : 0.035 max ≥ 16V : 0.05 max ≥ 10V : 0.075max					
	IR		More than 1,000 MΩor 50 MΩ × μF (Whichever is smaller)							
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	Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks) <table><tr><td>Peakvalue</td><td>Duration</td><td>Wave</td></tr><tr><td>1,500G</td><td>0.5ms</td><td>Half sine</td></tr></table>	Peakvalue	Duration	Wave	1,500G	0.5ms	Half sine
		Peakvalue	Duration		Wave					
		1,500G	0.5ms		Half sine					
		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×C (C : Capacitance)								
Tanδ	CLASS II	Rated Voltage ≥ 25V : 0.025 max ≥ 16V : 0.035 max ≥ 10V : 0.05max								
	IR		More than 10,000 MΩor 500 MΩ × μF (Whichever is smaller)							

Part Numbering
System

General
Capacitors

High Capacitance
Capacitors

Super Small Size
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

No	Item		Performance	Test Condition
11	Vibration	Appearance	No abnormal exterior appearance	5g's for 20min., 12cycles each of 3 orientations, Use 8" x5" PCB 0.031" Thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10~2000 Hz.
		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	
12	Resistance to Solder Heat	IR	More than 10,000 $\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ (Whichever is smaller)	Solder pot : $260 \pm 5^\circ\text{C}$, $10 \pm 1\text{sec}$.
		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)	
13	Thermal Shock	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	$-55^\circ\text{C}/+125^\circ\text{C}$ Note: Number of cycles required - 300, Maximum transfer time-20 sec, Dwell time-15min. Air-Air
		IR	More than 10,000 $\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ (Whichever is smaller)	
		Appearance	No abnormal exterior appearance	
		Capacitance Change	CLASS I Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)	
			CLASS II Within $\pm 10\%$	
14	ESD	Q	CLASS I Capacitance $\geq 30\text{pF}$: $Q \geq 1,000$ $< 30\text{pF}$: $Q \geq 400 + 20 \times C$ (C : Capacitance)	AEC-Q200-002
		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	
		IR	More than 10,000 $\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ (Whichever is smaller)	
		Capacitance Change	CLASS I Within $\pm 2.5\%$ or 0.25pF, (Whichever is larger)	
			CLASS II Within $\pm 10\%$	

No	Item			Performance	Test Condition																		
15	Solderability			95% of the terminations is to be soldered evenly and continuously	a) Preheat at 155℃ for 4 hours, Immerse in solder for 5s at 235±5℃ b) Steam aging for 8 hours, Immerse in solder for 5s at 235±5℃ c) Steam aging for 8 hours, Immerse in solder for 120s at 260±5℃ solder : a solution ethanol and rosin																		
16	Electrical Characterization	Capacitance		Within specified tolerance	The Capacitance /D.F. should be measured at 25℃, <table><tr><td>Class</td><td>Capacitance</td><td>Frequency</td><td>Vrms</td></tr><tr><td rowspan="2">Class I</td><td>1000pF ↓</td><td>1 MHz ±10%</td><td>0.5~5Vrms</td></tr><tr><td>1000pF ↑</td><td>1 kHz ±10%</td><td>1.0±0.2Vrms</td></tr><tr><td rowspan="2">Class II</td><td>10 μF ↓</td><td>1 kHz ±10%</td><td>1.0±0.2Vrms</td></tr><tr><td>10 μF ↑</td><td>120 Hz ±20%</td><td>0.5±0.1Vrms</td></tr></table>	Class	Capacitance	Frequency	Vrms	Class I	1000pF ↓	1 MHz ±10%	0.5~5Vrms	1000pF ↑	1 kHz ±10%	1.0±0.2Vrms	Class II	10 μF ↓	1 kHz ±10%	1.0±0.2Vrms	10 μF ↑	120 Hz ±20%	0.5±0.1Vrms
		Class	Capacitance	Frequency		Vrms																	
		Class I	1000pF ↓	1 MHz ±10%		0.5~5Vrms																	
			1000pF ↑	1 kHz ±10%		1.0±0.2Vrms																	
		Class II	10 μF ↓	1 kHz ±10%	1.0±0.2Vrms																		
			10 μF ↑	120 Hz ±20%	0.5±0.1Vrms																		
		Q	CLASS I	Capacitance ≥ 30pF : Q ≥ 1,000 < 30pF : Q ≥ 400 +20×C (C: Capacitance)	I.R. should be measured with a DC voltage not exceeding Rated Voltage @25℃, @125℃ for 60~120 sec. Dielectric Strength : 250% of the rated voltage for 1~5 seconds The charge/discharge current is less than 50mA.																		
						Tanδ	CLASS II	Rated Voltage ≥ 25V : 0.025 max ≥ 16V : 0.035 max ≥ 10V : 0.05max															
		IR@25℃	CLASS I	More than 100,000 μΩ or 1,000 μΩ × μF (Whichever is smaller)																			
			CLASS II	More than 10,000 μΩ or 500 μΩ × μF (Whichever is smaller)																			
IR@125℃	CLASS I	More than 10,000 μΩ or 100 μΩ × μF (Whichever is smaller)																					
	CLASS II	More than 1,000 μΩ or 10 μΩ × μF (Whichever is smaller)																					
Dielectric Strength		No dielectric breakdown or mechanical breakdown																					
17	Board Flex	Appearance		Bending to the limit for 5 seconds Limit : Class I - 3mm Class II - 2mm																			
		Capacitance Change	CLASS I			Within ±5.0% or 0.5pF, (Whichever is larger)																	
			CLASS II			Within ±10%																	
18	Terminal Strength(SMD)	Appearance		18N, for 60±1 sec. * 0603(1608) –10N, 0402(1005) –2N																			
		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 Temperature Characteristics	Capacitance Change	CLASS I	0±30 ppm/℃	<table><tr><td>Step</td><td>Temperature(℃)</td><td>Time(min)</td></tr><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></table>	Step	Temperature(℃)	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(℃)		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/℃																					
	Capacitance Drift	CLASS I	Within ±0.2% or 0.05pF, (Whichever is larger)																				

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

Part Numbering
System

General
Capacitors

High Capacitance
Capacitors

Super Small Size
Capacitors

Medium-High
Voltage Capacitors

Array Type
Capacitors

Low ESL
Capacitors

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