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(㎜)
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 = 0.50㎜ 6= 0.60㎜ 8 = 0.80㎜ C = 0.85㎜
P = 1.15㎜ F = 1.25㎜ H = 1.60㎜ J = 2.50㎜

※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
P = Bulk Case
C = Cardboard Tape, 7"Reel
O = Cardboard Tape, 10"Reel
D = Cardboard Tape, 13"Reel(10,000ea)
L = Cardboard Tape, 13"Reel(15,000ea)
E = Embossed Type, 7"Reel
F = Embossed Type, 13"Reel
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(℃)	Temperature Coefficient Range(ppm/℃)
C	C0G	-55 ~ +125	0 ±30

Class Ⅱ

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

★★

Capacitance Tolerance

Code	Capacitance Tolerance	TC	Capacitance Step	Rated Capacitance
C	±0.25 pF	C0G	Under 5 pF	E-12 series ★
D	±0.5 pF	C0G	6.0 to 9.0 pF	E-12 series ★
J	±5 %	C0G	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

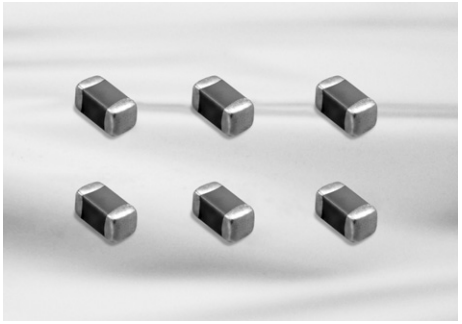
★E-24 series is also available

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.



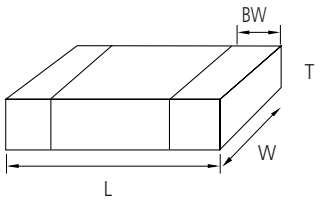
Feature

- 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.
- C0G 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, Infortainment)

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)	0.2+0.15/-0.1
10	0603	1.60±0.10	0.80±0.10	0.80(±0.10)	0.3±0.2
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)	
31	1206	3.20±0.20	1.60±0.20	0.85(±0.15)	0.5±0.3
				1.15(±0.10)	
				1.60(±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 0.85 1.25	50	■	■	■	■	■	■	■			
			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	50	■	■	■							
	0603(1608)	0.80	10	■	■	■	■	■	■				
		0.80	16	■	■	■	■	■	■				
		0.80	25	■	■	■	■	■	■				
		0.80	50	■	■	■	■	■					
		0.80	100	■	■								
	0805(2012)	1.25	10			■	■	■	■	■			
		0.85 1.25	16			■	■						
						■	■	■	■	■			
		0.60 0.85 1.25	25	■	■								
						■	■						
						■	■	■	■	■			
		0.60 0.85 1.25	50	■	■								
						■	■						
						■	■	■	■				
		0.60 0.85 1.25	100	■	■								
						■	■						
						■	■						
	1206(3216)	1.60	10				■	■	■	■	■		
		1.15 1.60	16				■	■	■	■			
							■	■	■	■	■		
		0.85 1.15 1.60	25				■	■	■				
							■	■	■	■			
							■	■	■	■	■		
		0.85 1.15 1.60	50				■						
							■	■					
							■	■	■	■	■		

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_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	2.2pF	50	±0.25pF	0.9
6	CL10C2R2CC81PN □		2.2pF	100	±0.25pF	0.9
7	CL10C3R3CB81PN □		3.3pF	50	±0.25pF	0.9
8	CL10C3R3CC81PN □		3.3pF	100	±0.25pF	0.9
9	CL10C4R7CB81PN □		4.7pF	50	±0.25pF	0.9
10	CL10C4R7CC81PN □		4.7pF	100	±0.25pF	0.9
11	CL10C6R8DB81PN □		6.8pF	50	±0.5pF	0.9
12	CL10C6R8DC81PN □		6.8pF	100	±0.5pF	0.9
13	CL10C100JB81PN □		10pF	50	±5%	0.9
14	CL10C100JC81PN □		10pF	100	±5%	0.9
15	CL10C120JB81PN □		12pF	50	±5%	0.9
16	CL10C120JC81PN □		12pF	100	±5%	0.9
17	CL10C150JB81PN □		15pF	50	±5%	0.9
18	CL10C150JC81PN □		15pF	100	±5%	0.9
19	CL10C180JB81PN □		18pF	50	±5%	0.9
20	CL10C180JC81PN □		18pF	100	±5%	0.9
21	CL10C220JB81PN □		22pF	50	±5%	0.9
22	CL10C220JC81PN □		22pF	100	±5%	0.9
23	CL10C270JB81PN □		27pF	50	±5%	0.9
24	CL10C270JC81PN □		27pF	100	±5%	0.9
25	CL10C330JB81PN □		33pF	50	±5%	0.9
26	CL10C330JC81PN □		33pF	100	±5%	0.9
27	CL10C390JB81PN □		39pF	50	±5%	0.9
28	CL10C390JC81PN □		39pF	100	±5%	0.9
29	CL10C470JB81PN □		47pF	50	±5%	0.9
30	CL10C470JC81PN □		47pF	100	±5%	0.9
31	CL10C560JB81PN □		56pF	50	±5%	0.9
32	CL10C560JC81PN □		56pF	100	±5%	0.9
33	CL10C680JB81PN □		68pF	50	±5%	0.9
34	CL10C680JC81PN □		68pF	100	±5%	0.9
35	CL10C820JB81PN □		82pF	50	±5%	0.9
36	CL10C820JC81PN □		82pF	100	±5%	0.9
37	CL10C101JB81PN □		100pF	50	±5%	0.9
38	CL10C101JC81PN □		100pF	100	±5%	0.9
39	CL10C121JB81PN □		120pF	50	±5%	0.9
40	CL10C151JB81PN □		150pF	50	±5%	0.9
41	CL10C221JB81PN □		220pF	50	±5%	0.9
42	CL10C271JB81PN □		270pF	50	±5%	0.9
43	CL10C331JB81PN □		330pF	50	±5%	0.9
44	CL10C391JB81PN □		390pF	50	±5%	0.9
45	CL10C471JB81PN □		470pF	50	±5%	0.9
46	CL10C561JB81PN □		560pF	50	±5%	0.9
47	CL10C681JB81PN □		680pF	50	±5%	0.9
48	CL10C821JB81PN □		820pF	50	±5%	0.9
49	CL10C102JB81PN □		1000pF	50	±5%	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)
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 □		1000pF	50	±5%	0.95
45	CL21C102JCC1PN □		1000pF	100	±5%	0.95
46	CL21C102JCF1PN □		1000pF	100	±5%	1.35
47	CL21C122JBC1PN □		1200pF	50	±5%	0.95
48	CL21C152JBC1PN □		1500pF	50	±5%	0.95
49	CL21C182JBC1PN □		1800pF	50	±5%	0.95
50	CL21C222JBC1PN □		2200pF	50	±5%	0.95
51	CL21C272JBC1PN □		2700pF	50	±5%	0.95
52	CL21C332JBC1PN □		3300pF	50	±5%	0.95
53	CL21C392JBC1PN □		3900pF	50	±5%	0.95
54	CL21C472JBC1PN □		4700pF	50	±5%	0.95
55	CL21C562JBC1PN □		5600pF	50	±5%	0.95
56	CL21C102JBF1PN □		1000pF	50	±5%	1.35
57	CL21C122JBF1PN □		1200pF	50	±5%	1.35
58	CL21C152JBF1PN □		1500pF	50	±5%	1.35
59	CL21C182JBF1PN □		1800pF	50	±5%	1.35
60	CL21C222JBF1PN □		2200pF	50	±5%	1.35
61	CL21C272JBF1PN □		2700pF	50	±5%	1.35
62	CL21C332JBF1PN □		3300pF	50	±5%	1.35
63	CL21C392JBF1PN □		3900pF	50	±5%	1.35
64	CL21C472JBF1PN □		4700pF	50	±5%	1.35
65	CL21C562JBF1PN □		5600pF	50	±5%	1.35
66	CL21C682JBF1PN □		6800pF	50	±5%	1.35
67	CL21C822JBF1PN □		8200pF	50	±5%	1.35
68	CL21C103JBF1PN □		10000pF	50	±5%	1.35

※ □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)
1	CL05B223KB54PN □	1.00×0.50	22㎋	50	±10%	0.55
1	CL10B221KC85PN □	1.60×0.80	0.22㎋	100	±10%	0.90
2	CL10B471KC85PN □		0.47㎋	100	±10%	0.90
3	CL10B102KB85PN □		1.0㎋	50	±10%	0.90
4	CL10B102KC85PN □		1.0㎋	100	±10%	0.90
5	CL10B222KB85PN □		2.2㎋	50	±10%	0.90
6	CL10B222KC85PN □		2.2㎋	100	±10%	0.90
7	CL10B472KB85PN □		4.7㎋	50	±10%	0.90
8	CL10B472KC85PN □		4.7㎋	100	±10%	0.90
9	CL10B103KA85PN □		10㎋	25	±10%	0.90
10	CL10B103KB85PN □		10㎋	50	±10%	0.90
11	CL10B103KC85PN □		10㎋	100	±10%	0.90
12	CL10B153KA85PN □		15㎋	25	±10%	0.90
13	CL10B153KB85PN □		15㎋	50	±10%	0.90
14	CL10B223KA85PN □		22㎋	25	±10%	0.90
15	CL10B223KB85PN □		22㎋	50	±10%	0.90
16	CL10B333KA85PN □		33㎋	25	±10%	0.90
17	CL10B333KB85PN □		33㎋	50	±10%	0.90
18	CL10B473KO85PN □		47㎋	16	±10%	0.90
19	CL10B473KA85PN □		47㎋	25	±10%	0.90
20	CL10B473KB85PN □		47㎋	50	±10%	0.90
21	CL10B683KO85PN □		68㎋	16	±10%	0.90
22	CL10B683KA85PN □		68㎋	25	±10%	0.90
23	CL10B683KB85PN □		68㎋	50	±10%	0.90
24	CL10B104KO85PN □		100㎋	16	±10%	0.90
25	CL10B104KA85PN □		100㎋	25	±10%	0.90
26	CL10B104KB85PN □		100㎋	50	±10%	0.90
27	CL10B154KO84PN □		150㎋	16	±10%	0.90
28	CL10B154KA84PN □		150㎋	25	±10%	0.90
29	CL10B224KO84PN □		220㎋	16	±10%	0.90
30	CL10B224KA84PN □		220㎋	25	±10%	0.90
31	CL10B334KO84PN □		330㎋	16	±10%	0.90
32	CL10B334KA84PN □		330㎋	25	±10%	0.90
33	CL10B474KO84PN □		470㎋	16	±10%	0.90
34	CL10B474KA84PN □		470㎋	25	±10%	0.90
1	CL21B102KB65PN □	2.00×1.25	1.0㎋	50	±10%	0.70
2	CL21B102KC65PN □		1.0㎋	100	±10%	0.70
3	CL21B222KB65PN □		2.2nF	50	±10%	0.70
4	CL21B222KC65PN □		2.2㎋	100	±10%	0.70
5	CL21B472KB65PN □		4.7㎋	50	±10%	0.70
6	CL21B472KC65PN □		4.7㎋	100	±10%	0.70
7	CL21B103KB65PN □		10㎋	50	±10%	0.70
8	CL21B103KC65PN □		10㎋	100	±10%	0.70
9	CL21B153KB65PN □		15㎋	50	±10%	0.70
10	CL21B153KC65PN □		15㎋	100	±10%	0.70
11	CL21B223KB65PN □		22㎋	50	±10%	0.70
12	CL21B223KC65PN □		22㎋	100	±10%	0.70
13	CL21B333KBC5PN □		33㎋	50	±10%	0.95
14	CL21B333KCC5PN		33㎋	100	±10%	0.95

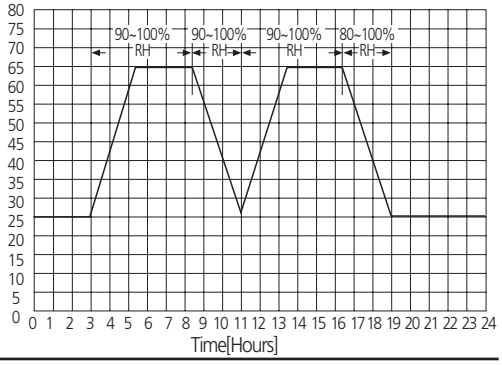
※ □mark means packaging code. If you want to learn the code or quantity in detail, please see p80.

Product Lineup (Automotive Capacitors_X7R)

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

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

Reliability Test Condition (Automotive Capacitors)

<table>
<tr><th>No</th><th colspan="3">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>1</td><td colspan="3">Pre-and Post-Stress
Electrical Test</td><td>-</td><td></td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">High Temperature
Exposure</td><td>Appearance</td><td></td><td>No abnormal exterior appearance</td><td rowspan="5">Unpowered, 1000hrs@T=150℃
Measurement at 24±2hrs after test conclusion</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>Q</td><td>CLASS Ⅰ</td><td>Capacitance ≥ 30pF : Q ≥1,000
＜30pF : Q ≥400 +20×C
(C : Capacitance)</td></tr>
<tr><td>Tanδ</td><td>CLASS Ⅱ</td><td>Rated Voltage ≥ 25V : 0.03 max
≥ 16V : 0.05 max
≥ 10V : 0.075 max</td></tr>
<tr><td colspan="2">IR</td><td>More than 10,000 MΩor 500 MΩ × μF
(Whichever is smaller)</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Temperature
Cycling</td><td>Appearance</td><td></td><td>No abnormal exterior appearance</td><td rowspan="5">1000Cycles
Measurement at 24±2hrs after test conclusion
<table><tr><th>Step</th><th>Temperature(℃)</th><th>Time(min.)</th></tr><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></table></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>Q</td><td>CLASS Ⅰ</td><td>Capacitance ≥ 30pF : Q ≥1,000
＜30pF : Q ≥400 +20×C
(C : Capacitance)</td></tr>
<tr><td>Tanδ</td><td>CLASS Ⅱ</td><td>Rated Voltage ≥ 25V : 0.03 max
≥ 16V : 0.05 max
≥ 10V : 0.075max</td></tr>
<tr><td colspan="2">IR</td><td>More than 10,000 MΩor 500 MΩ × μF
(Whichever is smaller)</td></tr>
<tr><td>4</td><td colspan="3">Destructive Physical
Analysis</td><td>No defects or abnormalities</td><td>Per EIA 469</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Moisture Resistance</td><td>Appearance</td><td></td><td>No abnormal exterior appearance</td><td rowspan="5">10Cycles, t=24hrs/cycle
Heat (25~65℃) and humidity (80~98%), Unpowered
measurement at 24±2hrs after test conclusion
 
</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 ±12.5%</td></tr>
<tr><td>Q</td><td>CLASS Ⅰ</td><td>Capacitance ≥ 30pF : Q ≥350
＜ 10pF : Q ≥275+(5/2)×C
＜ 10pF : Q ≥200+10×C
(C : Capacitance)</td></tr>
<tr><td>Tanδ</td><td>CLASS Ⅱ</td><td>Rated Voltage ≥ 25V : 0.03 max
≥ 16V : 0.05 max
≥ 10V : 0.075max</td></tr>
<tr><td colspan="2">IR</td><td>More than 10,000 MΩor 500 MΩ × μF
(Whichever is smaller)</td></tr>
</table>

* For the more detail Specification, Please refer to the Samsung MLCC catalogue.

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) Peakvalue: 1,500G / Duration: 0.5ms / Wave: 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)	

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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" ×5" 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 ㎐.
		Capacitance Change	CLASS Ⅰ	Within±2.5% or 0.25pF, (Whichever is larger)	
			CLASS Ⅱ	Within ±10%	
		Q	CLASS Ⅰ	Capacitance ≥ 30㎊ : Q ≥1,000 ＜30㎊ : 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 ㏁or 500 ㏁ × ㎌ (Whichever is smaller)	
12	Resistance to Solder Heat	Appearance		No abnormal exterior appearance	Solder pot : 260±5℃, 10±1sec.
		Capacitance Change	CLASS Ⅰ	Within ±2.5% or 0.25pF, (Whichever is larger)	
			CLASS Ⅱ	Within ±10%	
		Q	CLASS Ⅰ	Capacitance ≥ 30㎊ : Q ≥1,000 ＜ 30㎊: 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 ㏁or 500 ㏁ × ㎌ (Whichever is smaller)	
13	Thermal Shock	Appearance		No abnormal exterior appearance	-55℃/+125℃ Note: Number of cycles required - 300, Maximum transfer time-20 sec, Dwell time-15min. Air-Air
		Capacitance Change	CLASS Ⅰ	Within ±2.5% or 0.25pF, (Whichever is larger)	
			CLASS Ⅱ	Within ±10%	
		Q	CLASS Ⅰ	Capacitance ≥ 30㎊ : Q ≥1,000 ＜30㎊: 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 ㏁or 500 ㏁ × ㎌ (Whichever is smaller)	
14	ESD	Appearance		No abnormal exterior appearance	AEC-Q200-002
		Capacitance Change	CLASS Ⅰ	Within±2.5% or 0.25pF, (Whichever is larger)	
			CLASS Ⅱ	Within ±10%	
		Q	CLASS Ⅰ	Capacitance ≥ 30㎊ : Q ≥1,000 ＜ 30㎊ : 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 ㏁or 500 ㏁ × ㎌ (Whichever is smaller)	

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<table>
<tr><th>No</th><th colspan="3">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>15</td><td colspan="2">Solderability</td><td></td><td>95% of the terminations is to be soldered evenly and continuously</td><td>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</td></tr>
<tr><td rowspan="8">16</td><td rowspan="8">Electrical Characterization</td><td colspan="2">Capacitance</td><td>Within specified tolerance</td><td rowspan="8">The Capacitance /D.F. should be measured at 25℃,
<table><tr><th>Class</th><th>Capacitance</th><th>Frequency</th><th>Vrms</th></tr><tr><td rowspan="2">Class Ⅰ</td><td>1000pF ↓</td><td>1 ㎒ ±10%</td><td>0.5~5Vrms</td></tr><tr><td>1000pF ↑</td><td>1 ㎑ ±10%</td><td>1.0±0.2Vrms</td></tr><tr><td rowspan="2">Class Ⅱ</td><td>10 ㎌ ↓</td><td>1 ㎑ ±10%</td><td>1.0±0.2Vrms</td></tr><tr><td>10 ㎌ ↑</td><td>120 ㎐ ±20%</td><td>0.5±0.1Vrms</td></tr></table>
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.</td></tr>
<tr><td>Q</td><td>CLASS Ⅰ</td><td>Capacitance ≥ 30pF : Q ≥1,000
＜30pF : Q ≥ 400 +20×C
(C: Capacitance)</td></tr>
<tr><td>Tanδ</td><td>CLASS Ⅱ</td><td>Rated Voltage≥ 25V : 0.025 max
≥ 16V : 0.035 max
≥ 10V : 0.05max</td></tr>
<tr><td rowspan="2">IR@25℃</td><td>CLASS Ⅰ</td><td>More than 100,000 ㏁or 1,000 ㏁ × ㎌
(Whichever is smaller)</td></tr>
<tr><td>CLASS Ⅱ</td><td>More than 10,000 ㏁or 500 ㏁ × ㎌
(Whichever is smaller)</td></tr>
<tr><td rowspan="2">IR@125℃</td><td>CLASS Ⅰ</td><td>More than 10,000 ㏁or 100 ㏁ × ㎌
(Whichever is smaller)</td></tr>
<tr><td>CLASS Ⅱ</td><td>More than 1,000 ㏁or 10 ㏁ × ㎌
(Whichever is smaller)</td></tr>
<tr><td colspan="2">Dielectric Strength</td><td>No dielectric breakdown or mechanical breakdown</td></tr>
<tr><td rowspan="3">17</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 5 seconds
Limit : Class Ⅰ - 3mm
Class Ⅱ - 2mm</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">18</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</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>19</td><td colspan="3">Beam Load</td><td>Destruction value should be exceed
Chip Length ≤2.5 ㎜
a) Chip Thickness > 0.5 ㎜ : 20N
b) Chip Thickness ≤0.5 ㎜ : 8N
Chip Length ≥ 3.2 ㎜
a) Chip Thickness ≥ 1.25 ㎜ : 54.5N
b) Chip Thickness < 1.25 ㎜ : 15N</td><td>Beam speed
Chip Length ≤2.5 ㎜, 0.5±0.05 ㎜/sec
Chip Length ≥3.2 ㎜, 2.5±0.25 ㎜/sec</td></tr>
<tr><td rowspan="4">20</td><td rowspan="4">Capacitance Temperature Characteristics</td><td rowspan="2">Capacitance Change</td><td>CLASS Ⅰ</td><td>0±30 ppm/℃</td><td rowspan="4"><table><tr><th>Step</th><th>Temperature(℃)</th><th>Time(min)</th></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></td></tr>
<tr><td>CLASS Ⅱ</td><td>Within ±15%</td></tr>
<tr><td>Temperature Coefficient</td><td>CLASS Ⅰ</td><td>0±30 ppm/℃</td></tr>
<tr><td>Capacitance Drift</td><td>CLASS Ⅰ</td><td>Within ±0.2% or 0.05pF,
(Whichever is larger)</td></tr>
</table>

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